Alfred H. White

Proceedings

of

Thirteenth Annual Meeting

of the

MICHIGAN GAS ASSOCIATION

held at

Detroit, September 20-21-22, 1905

Contents:

PROCEEDINGS

OF THE

THIRTEENTH ANNUAL MEETING

OF THE

MICHIGAN GAS ASSOCIATION

HELD AT DETROIT, MICHIGAN

SEPTEMBER 20, 21 AND 22
1905

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Detroit, Michigan.

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ANNUAL ADDRESS OF THE PRESIDENT.

Ernest F. Lloyd.

In considering the address which custom has decreed the President of this Asociation shall make at the Meeting concluding his term of office, it has seemed to me that the idea of withholding the subject from the previous knowledge of the members and its usual reference to a small committee, has been a practice open to some improvement. I hope, therefore, that it may meet with the approval of the Association that this year the address has taken the course of the papers to be presented, and that the Chairman will open it to general discussion. Certainly it has seemed to me fitting that the review of events or the expressed opinions of a responsible officer of the Association should not be allowed to pass without the members having such opportunity fully and promptly.

The year that has passed, although not marked by any unusual advance in production practice, has nevertheless been one of developing progress. Encouraging signs of the healthy activity and alertness of our business are to be found in the increasing employment of technically educated men in the manufacturing and engineering departments and the application of sound and energetic business methods in its commercial branches.

This commercial development has made such rapid strides in the last few years, that it may be looked upon as having been revolutionized. Better appointed offices, greater attention to the legitimate wants of consumers, an effort to anticipate these wants and to create a demand for gas, is manifested now by every company of any pretensions whatever. At the same time there has been a wholesome tendency to distinguish between the different characters of service, to analyze the relative profitableness of consumers, and to thereby make such rates as will increase both the service to the public and the net income of the company. These questions will be found to have had considerable thought devoted to them by those who have prepared subjects for your consideration at this meeting.

I will not therefore occupy your time with a review of matters which will be much better presented to you by the writers of the papers to be read, but rather solicit your attention o some of those features which are apt to escape our attention in the

pressing routine of daily work. These will crystalize around the future of our Association.

Prehaps, first to be considered should be the effort which has been made to organize a National Association and its present status. The apathy with which this has been received, or the objections which have been directed against it may be taken as evidence that the gas interests of the country do not believe that there is a suitable field for such an organization, or that they fail to perceive their best interests. I incline to the first view. Theoretically the idea of one central body with branches or chapters in the various parts of the country, having at its command large funds for the prosecution of research, for the general protection of its interests and for the compilation of information is unquestionably an attractive proposition and one which originally enlisted my own support. Yet, in the light of more mature consideration, it is extremely doubtful whether such an organization could accomplish more than a little of what it would set out to do. The reasons for this would seem to me to group themselves under two general heads. First, that the scheme of organization does not offer methods intrinsically different from those now obtaining and with regard to which there is a fairly well defined but uncrystalized opinion that they are insufficient. And, secondly, that the magnitude of the undertaking and the distances involved, coupled with the extreme diversity of the interests to be served and the laws under which they operate would make the organization too unwieldy and too remote and impersonal to be effective for the individual member.

Let me attempt to define the general features of the problems before us.

From the technical aspect the installation and equipment of a gas plant is a matter of mechanical engineering. The subsequent operation involves chemical engineering in the production and ordinary trade methods in the sale of the product. Our educational institutions therefore at present largely have in their curricula the entire range of subjects which should be understood by the well-equipped gas engineer; though unquestionably a consolidation of these into a more concrete course with specific facilities for research would direct more attention to this branch of engineering. That these institutions have not given us more attention lies more with us than with them. A demand would be, as in all other lines, very quickly supplied, and under the State University work supported by the companies of this State, directed by this Association it is developing rapidly.

From the commercial aspect, the public should be educated through a broad and comprehensive policy of publicity through the press and otherwise to a greater knowledge of and familiarity

with our business in its various branches and to viewing in correct perspective the many economic fallacies which assail us and other quasi-public institutions. There is equally the valuable field of the current collection and compilation of the law of quasi-public corporations as it is made, interpreted and molded in the various legislative enacements and the daily decisions of the courts. Yet consideration will, I think, show that these functions should not be undertaken as a personal affair only of the associated officers and employees of the interests affected.

It is a point which must not be overlooked in any discussion of the matter, that in the last few years the character of the representation has undergone a radical change, so much so that all of our associations even on their present footing are now in a transition stage, the future of which is not yet clear. When most of them were founded and for many years thereafter, the members represented wholly independent companies. Today all those of importance save a few are under syndicate control, with many of our brightest men in their employ. These syndicates hold their own private meetings, when entire freedom of speech prevails and every detail of the business of each company is open to comparison with all the others and to the intimate criticism of all the participants. To my mind the ultimate effect of this condition will be the concentration of the work of the large associations upon those subjects of common open interest among the the offices of those syndiates with the few large independent enterprises and the very great development of strictly local or State organizations.

This brings us at once to the consideration of the possibilities, scope and value of our Michigan Association. Primarily, I believe, that the Michigan Gas Association should be reserved wholly for Michigan interests. This is not dictated by any feeling of exclusiveness, but rather, that if it would perform the functions which I will endeavor to outline, it would lose weight and influence by reason of the affiliation of any outside interests. We would always welcome fellow gas men, we would be glad to give our little knowledge and receive of their large store. We would not tax them and they would not vote. Members removing to activities without the State would thereby pass into an Honorary Service Class, without dues or vote. I would maintain the existing classes of membership, adding thereto that of the Gas Companies of Michigan. Under such an organization it would be strictly a Michigan Gas Association, composed of the Michigan Gas Companies and Michigan Gas Men. The necessary revenue for its purposes should be derived from individual dues as at present and from the companies represented. Each company should have a voting representation and dues

based upon its output, limited, however, so that the total expense to and voting strength of any one company should not exceed that of an average company. The management would be in the hands of officers and an executive committee. Its functions would be a discussion of all matters pertaining to the business as at present, but beyond that, its funds, on authority from the executive committee, should be usable for the purpose of supporting such educational features both technical and of a public character as might be found desirable; for preserving the interests of the Association in matters of both municipal and state legislation; for defending a member from unjust attack from any source; for investigating charges of inefficient service by any Company member; for recommending corrective measures where needed; and for such other purposes as might be deemed advantageous to the general good. A very recent example in this State of the necessity for activity in legislative matters has shown itself in a case where such an organization could have prevented by a little watchfulness a piece of legislative bungling which it was eventually necessary to undo at heavy expense. In a still more recent case the Detroit City Gas Company was put to the individual expense of maintaining in court a principle of vital importance to every Company in the State.

Properly conducted, the public confidence in such an Association would gradually and naturally grow to be an asset of incalculable value. The scheme of organization proposed is not theoretical, nor may I claim for it originality, it having been very fully developed from a most modest beginning and being now in successful operation among the employing interests of the City of Detroit. The scope and method differ; but the principle is essentially identical.

Some such form of organization in my opinion must eventually be evolved. From my experience in other directions I can see no serious obstacle, neither can I see that it should in any manner interfere with our present usefulness, but rather that this would be carried on to greater advantage than at present, and the scope of our activities for the good of the industry and the public be immensely broadened.

There are many questions which we shall in the future be called upon to face and settle, due to the unrestrained conduct of our business in the past. Quasi-public service is not a private affair of the owners only of such corporations; yet it has been so looked upon in this State in the past and unless wisely handled the consequences will be present to plague our future for many years. This business is by its nature an economic monopoly in that the community can be best served from a single supply. It is of no consequence to the discussion that the municipal

corporation does not here grant an exclusive franchise. The nature of the business makes it such. A franchise essentially should be a permit to the corporation from the municipality for the use of the public highways. In return for this license, the company should guarantee immunity from any responsibility attaching to the municipality by reason of such use and the mutuality of the agreement should be evidenced by an undertaking upon the part of the company to supply its product to the inhabitants of the municipality at a price yielding a reasonable dividend upon the capital required. Theoretically these conditions are supposed to be embodied in all franchises, but the treatment of the company as a piece of private property rather than as a quasi-public body has led to a failure to restrict the owners in its capitalization and to great secretiveness as to details. To these more than to any other causes, perhaps more than to all other causes combined, has arisen the fallacious propaganda of municipal ownership, the undue taxation imposed, and the continual attack to which the business is subject. In the earlier days of our gas activity when its use was primarily as an illuminant, the bonds and stock of a company generally represented either money that had been originally invested, or earnings that had been applied to the development of the property. This condition continued until the advent of the idea of using gas for other than illuminating purposes. The immense increase in output and inflated earnings possible with such increased use have been seized upon by many of those who have seen and appreciated the possibilities, with the result that reorganizations have been undertaken, capitalized upon a basis of the future earning possibilities and unusually far in excess of what was immediately in view. It is true that at first such stocks and even bonds had a market value of only a fraction of their par value, nevertheless this capitalization existing, as the earnings increased and dividends were paid, it became gradually assumed that the property would continue to earn such returns and the the securities naturally inflated in sympathy with this feeling. The injustice to the public is perhaps no greater from this source than from many others due to the laxity of our corporate laws, but it is unquestionably responsible for the evils I have mentioned. Beyond question much can be said to show that the reorganizations and over capitalizations were justifiable in the sense that they did not give an undue reward to those who had the sagacity and were thereby attracted to employ it in serving the public more efficiently than had ever been done before.

If then we have at hand the means of counteracting by concerted effort the heresies which find their way into the public press through uninformed writers and without contradiction, it

would place the public service corporations in a more correct perspective in the public eye.

Sooner or later the State will undertake some measure of regulation, and it will be well for those in control at such time if they may be in position to aid in sane and check vicious legislation. The public is not unreasonable if it is reasonably treated, if its way is made easy and if it is properly and fully informed. As Corporations we are legal individuals and in the larger as well as in a selfish sense, we are each other's keeper. A lax, an indifferent or a bad management extends a malign influence over all its neighbors. A knowledge upon the part of the public that an enterprise so conducted fails to meet the approval of the business within the State as a whole, would inspire a confidence of the most far-reaching and intestimable value.

The functions of our organization should be in the nature of a self inquisition. No company should be admitted to it or permitted to remain in it except its methods met with the approval of the majority of the members. Support should be refused to any company wilfully misusing its privileges an dthe mere fact of the carrying out of a high principle of action would inevitably and speedily instil in the public mind the same feeling of confidence in the Association which has stood the Employers of Detroit in such good stead and be worth many times over more than the possible cost or trouble of such an organization.

That our existing organizations do not meet our present necessities is obvious to the most casual observer. It is a quality of the human mind that it clings to an established form long after the substance has disappeared. The inertia of the mind, sometimes miscalled "conservatism" is next to selfishness, the greatest stumbling block in out ethical development. Because a practice or a form was highly beneficial to our fathers is no manner of reason that it is suitable to us. Nations are formed and rise from obscurity to greatness through the pursuit of an idea unhampered by tradition. As these are accumulated they stagnate, then wane. Societies' organization pursue the same course.

On all sides in this country we hear complaint of our gas associations—they are run by cliques, the man who serves them has an axe to grind, their proceedings are tame or uninteresting! All of which has some and some much of truth. Why not recognize that the conditions which brought them into being are modified or are past, that the forms are inoperative for the present and dead for the future. My stand is that our organization is not today able or competent to successfully meet the conditions which confront our business in this State. That our problems are up to us, right here and not to somebody in New York

or California. That we cannot meet them as individuals nor as associated individuals nor yet as isolated companies. When the problems were only technical, the technical members got together for the advantages of joint work; later the sales agents, the business end were added in. Now when the very existence of the Companies themselves is threatened through the various forms of socialistic propaganda it is time that the companies should organize for combined resistance to the assault.

I appreciate that the Association neither could nor should entertain so radical a change without exhaustive discussion and self-education. I therefore recommend that a committee be appointed to investigate the subject of "broadening the scope of our association, by creating a Company membership" with instructions to submit a report for printed distribution among the members at least two months before the next Annual Meeting.

There are many other matters of general interest which might well claim our attention but those which are most vital affect us as associated companies rather than as associated officers, and I would therefore postpone them until we may know if we may meet them together or if we must meet them singly.

DISCUSSION.

Chairman—Gentlemen, you have heard the address of the President, which is of unusual interest. It brings up a point of very vital importance, and I believe we will be justified in dispensing with the customary appointing of a committee to report upon the President's address, and resolve the Association into a Committee of the Whole for discussion of this address.

Mr. Wolff—Mr. President, I want to say, as having been deeply interested in some things that have been done in this city within the last year, that I am very glad to see the President devote so much of his time and thought to this question, of what we might term, public policy. I think that it is a problem that cannot be easily worked out. You have encountered the inertia of mind that he speaks of at a number of points in this good State of ours that will need some hard labor to put into action. That will apply particularly to the smaller towns where municipal ownership fad is proposed, but not been developed to the extent that it has in the larger communities, from the very fact that the companies are small, and in a way, their activities have not been considered of sufficient importance to merit the attention of the ward heeler and the political—what shall I call him—scavenger. I think that particuar feature will require more hard work,

and the equalization of the burden of carrying on that work than any other one thing. It seems to me, that in this work, the gas companies of Michigan should not be alone. There are street railways, electric light and power, and water companies that should ,and ought to come in and help us carry on this work. I think the President has given us some things to think about in his address that are of the greatest importance.

Mr. Knight—It can't be possible there is a man here who questions the importance of the suggestions made in the President's paper.

That Mr. Lloyd has set forth the most important work this Association can do, scarcely needs discussion, and we ought to spend our time devising ways and means to bring about what he has suggested. I cannot tell how it can be done, but I am ready to help do it and help talk about it. I want to just say a word regarding what Mr. Wolff has said. We cannot get the co-operation of all the companies he has mentioned, and it won't do to let the work stop because we cannot. If the Employers' Association in Detroit, when there was fifteen of them, had said we won't do anything unless we can get everybody to work there would not have been anything done. There is a lot of work to be done and we ought to make a start.

The work, if done well, will involve some expense, at least, I have found it costs money to get the best work. Some men must give it their time and make it their business, and while we are all willing to contribute with suggestions, etc., yet, a determined effort along this line, to avail much, must have funds as well.

We have got to meet such questions as restrictive legislation, increasing taxation, municipal ownership, fair franchise privileges, etc., etc.

We must get in shape to meet intelligently all of the various questions which pertain to public service corporations, and which are continually being exploited in the newspapers, and by agitators, some of whom are honest, and many of whom are in the business for revenue only.

When a man comes along and says gas can be made for 10c a thousand there should be some way to demonstrate in a convincing way what it does actually cost to make and deliver gas. If I understand Mr. Lloyd's paper, that is what he means, and that is what we ought to do. I want to hear from somebody as to how to get at it, and the quickest and the best way, and I am ready to coöperate.

Mr. Cobb—Mr. President, without any undue flattery, I think the President's address is the most comprehensive one that certainly I have ever listened to in the Michigan Gas Association.

I do not quite agree with him on one or two little items, that is, that our fellow gas men from other States should not be admitted to membership. I think if they want to come into our Association that we should welcome them and keep them and take good care of them.

Now, it does not seem to me it should be such a difficult matter to outline a plan, or to get this work started. As Mr. Lloyd said, it is more or less fashioned along the lines of the Employers' Association, such as they have here in Detroit. I know that Mr. Hodges and Mr. Whirl and the other officers of the Employers' Association would give any committee that was appointed by our Association any aid that was necessary; and from the experience that they have had we could certainly, in a very short time, get up a plan, or mode of procedure, which would answer our needs. I think that a great deal of thought should be given to the appointment of such a committee so that our State shall be well represented and our Association shall be well represented. Mr. Wolff spoke about the other interests like electricity and street railroad interests. I agree with Mr. Knight it would be difficult work to get the street railroad interests and electric light interests to amalgamate with the gas interests in such an Associaion. Particularly that when it was once known throughout the State that all of these corporate interests had united in one, you would no doubt have strong opposition and you would arouse antagonism at once in the mind of the public. It would seem to me it would be better to have each one of these large and separate interests carry on their own work, and have a mutual understanding with one another through the officers of the individual Associations.

Mr. Lathrop—I think the suggestions which Mr. Lloyd has made in here, a great many of them are worthy of strictest attention and consideration. There is no question but what the mutuality of interests of the companies located within the confines of the State are such that they must keep together and work together. That should not be lost sight of. His suggestion relative to franchises is right, and I believe that we ought to educate the people along the lines that it is to their interest to grant exclusive, and possibly perpetual franchises. If they do that it gives them every advantage which can possibly be claimed for municipal ownership, or municipal control, and which will also avoid the dangers of overcapitalization which Mr. Lloyd refers to. I could not say that the methods which Mr. Lloyd suggests here are all of them the best, but I think the suggestions should be studied over carefully and worked out, because I think they are very good indeed.

Mr. Persons—I have not much to say on this subject in this

State. I advocate a strong State organization that will protect the interests of local companies, and I am very much in favor of one large Association for American gas interests. I am very sure that a State organization would be effective. I should take up on very broad lines all the questions of general interest to gas companies throughout the State. I feel very sure that organizations will be effected in every State for protection purposes. I think it is imperative that it should be done, and should be done at once. The Gas Commission of Massachusetts has been a saving clause to a great many of the gas companies there. That gas commission happens to have at the head of it a man who is a very fine gentleman, and everything has gone very smoothly there, but the average gas commission would be composed of politicians, and perhaps only in business for political purposes ,and it would be a very unsafe thing in most cases. The State organizations have to take up the work of self protection against municipal ownership and unjust legislation.

Mr. Douglas—It seems to me if this Association is ever to do anything the line outlined by Mr. Lloyd, or in any line other than a discussion of technical papers, that our organization has to be entirely different from what it is now. We have no strong ties between the members of the Association other than their common interest. We have nothing which would bind anybody to do anything or to follow certain lines of policy. It seems to me very important that, if possible, we organize on a different basis than what we have now. A member of this committee should be appointed, as suggested by Mr. Lloyd, to make a report in advance of the next meeting so that we can have it at that time, and be in a position to take it up definitely, and make some definite agreement. I think it is important that it should not be allowed to rest longer than that time.

Mr. Freese—I do not think I have anything to add to what has been said. I think the suggestion Mr. Douglas made about appointing this committee should be adopted.

Mr. Knight—It seems to me before that committee it appointed it would be well to hear from Mr. Lloyd. He has made a proposition here which appeals to us, apparently, and he has probably thought about how it can be worked out. If there is to be a committee appointed work should be done. This involves expense. Funds it should be provided with, so that the work will be done. I think he should act as chairman of the committee. I would like to hear from Mr. Lloyd, and perhaps have this committee make some sort of preliminary report at this meeting.

Mr. Lloyd—I might outline, Mr. Chairman, some points that were not brought out in respect to the Employers' Association

here. It is applicable only in a certain sense—would be when the time comes for extending it, as has been suggested to other corporations—of a quasi public character. There is no doubt but theoretically all those corporations are actually situated with ourselves, merely that the details of their operation vary. The underlying principle with them is the same as it is with us.

Originally, the Employers' Association here consisted of the metal workers. There was no strict division. Anybody engaged in the foundry, machinist and pattern making trades, those particularly belonging to what we call the Detroit Metal Trades Association. We found that the scope of the work was not sufficiently broad, and we affiliated with—or perhaps the reverse—anyway the brass association came in with us. The brass association at that time was probably as big as all our various branches put together. Then we called it the Employers' Association. We went through two years, and half a dozen more or less difficult strikes, and we won every one of them, absolutely. The last one was the strike of the boilermakers which lasted for eleven weeks. They had absolutely no grievance to start out with, but they simply proposed to show us a thing or two, and they did, among other things that we did not need to be scared of them. For those eleven weeks that those men were out, I do not think there was one of them got work anywhere in the city of Detroit. It was not because they were blacklisted, but they were told practically that it was a strike without cause or reason, and we would not take them in. When they declared the strike off, they were permitted to go to work anywhere they chose to get work, and there was no hard feeling engendered. That is one thing in treating with the laboring man that you must absolutely eliminate. You must treat with the men from an impersonal standpoint. They may abuse you, and wreck your factory, or do anything they choose, but you must not bear any malice against them. If you do, you will never have a successful organization. They have shot up some of our fellows, and thrown others under street cars, and have done various things, but our efforts have been directed against the men who committed the actual assaults. We have endeavored to attack them from the high standpoint of public policy, and not because they hurt us individually.

Now, from the success of the Employers' Association, particularly in dealing with a less serious strike, which, as I say, was the boilermakers', two years ago, we organized the building trades. There was a problem which presented difficulties of some magnitude. In fact, when we came to study that question, we found that the difficulties of the Employers had been practically nothing. Every builder in the city of Detroit, I might say without exception, was working under a Union agreement

—masons, plasterers, pipe fitters, carpenters and all other trades, about 25 or 30 trades that go to make up a building; whereas, if a strike occurred in a brass shop, it only affected the brass shops; it did not affect the machine shop, that could keep on working and supply funds to the brass shops, and the machinists would keep on working, and allow their funds, through the Federation of Labor, assist the brass makers. When it came to the builders, it was a different proposition. If the plumber struck on the building, there was not a mason who would lay a brick on the struck building. The whole problem was immensely broadened. Consequently nothing could be done by a few builders—we had to get them all in. Well, looking back over our experience, there were lots of curious things happened. I was one of a half-dozen forming the Executive Committee of the Employers' Association that met a lot of builders who were trying to get together and see what they could do. I do not think I ever spent an evening where I had more real fun. These fellows could not understand how we would treat with the Union, and when we got through treating with them, not have agreed to do anything with them. How we would go into a discussion with them, with the distinct understanding that we never would agree to do anything with them. It took some time to get that understood thoroughly . I will say this for the builders in Detroit, they had the object lesson before them, that if they did get together, they would probably be out of trouble. They all faced a universal building strike. They said, instead of going it alone, we will have it all together. They started out in March, when the weather was not very good for fishing, and the men would have to pay for coal to keep them warm hanging around home, instead of working. In about six weeks from the first meeting, we had those builders all in line. They had declared for the open shop, and they had stuck to it. There was a strike of the carpenters and painters. They got in some fellows, and one of our decorators said, I found out, after all, that a good painter is only a suit of white overalls and a brush, outside the man; so they got a lot of fellows and clothed them in white jumpers, gave them brushes and started them daubing paint, performing very good service. Presently they sent them out on the buildings. The men thought that these fellows were skilled painters, and began to get disheartened; and inside of two months from that time, the trouble was all over, although it never was very serious. You can see the magnitude of the problem in the sense that no one man could have succeeded, because their work was scattered all over the city, two or three men on a house here and there; whereas the employers had all their men together inside of the factory, and if they got them inside there, they could protect them, and you could protect 25

or 30 in our own shops, better than you could a dozen different buildings five miles apart.

The scheme of organization is, that each craft constitutes a division. In the Employers' Association, there are the machinists, the founders, the brass workers—all the brass trades associated—the pattern makers, the boiler makers . There are some other trades. In the Building Association, which are all the various associations, as masons, carpenters, plumbers, and so on. Each one of these various branches constitutes a distinct division. Lately we have organized, or rather brought in, the Board of Graphic Arts, which constitutes all the printing business in the city of Detroit, photo-engraving, electrotyping and various things of that sort. Each organization is a separate division. Each one of those divisions has its affairs carried on by a chairman and two members additonal, forming a divisions committee. That committee takes care of the ordinary affairs. It meets the individual union representative for that trade, discusses anything with him that it may see fit to discuss, if it be not a subject which we eliminate from discussion; for instance, the open shop, and the right to employ any man we please. That is a matter that is not open to discussion. If there is any question about it, there is a fight at once. Anything that any of these division committees approves, before it becomes effective, is submitted to the Executive Committee, which exists for each different branch, that is, the Employers' Association, or the Builders' Association, and the Chairman and Vice-Chairman of the Divisions Committee meet together; that and the Employers' Association committee consists of 18 men. That is a matter that is of vital importance. We join with that executive committee of the Employers' Association, for instance, and the executive committee of the builders, which forms a still higher court, so that finally there is a court of last resort as to what all the employing interests of Detroit will do in respect to any one problem which may come up, that is serious. But the minor matters of various sorts, as well as the more important matters are discussed respectively by the divisions committees and by the executive committees of each branch of association. That is the organization as it exists at present.

Its application to us would be, that we would be the gas interests. We would carry on our own work. We have certain problems which are pertinent to us, and not to electricity and not to water, and not to street railway interests. Before we can expect to present any proposition to these other people, we have to have our own house in order. We have to digest our own problems. If we set out to get all those other people interested in this proposition, we would fail just as sure as we did it, just as sure as we would have failed to have 300 people constituting

the organization in Detroit today, had we all gotten together in the first instance. It would have gone down, simply because they could not have understood the thing. You cannot grow to manhood in a year, or five years. It takes a certain length of time. So with an organization of this character you must educate your own members into what their own organization means, and we will have our hands full in doing that among the gas interests of this state before tackling anybody else. When we have brought that about, and are bettering our condition, the others will then be anxious to see how we have done it; and as the builders did with the Employers, they will come in and inquire, and we can point it out to them, and they will form their own organizations; and in questions of large moment, the funds of the associated organizations will be directed to a common object.

As the matter stands today, if it is necessary, all my funds, as a member of the Employers' Association, can be called upon to fight the printers' strike in Detroit. That seems a long way out, to suppose that a strike of printers affects me; but if the printers establish a proposition in this city that they will have the closed shop, and are successful in establishing it, it is another wedge to help the machinists establish the same principle; and it is a great deal better to me, from a selfish standpoint, to fight that strike in the printers' shop than in my own shop.

Mr. Wolff speaks of the universal feeling, especially in the smaller cities against gas companies.

Mr. Wolff (sotto voce): Just the reverse—larger cities.

Mr. Lloyd: There is a good deal in it. Now, why is it there? It has grown from small beginnings. It has kept on rising, and whoever contradicts it? If a man gets up and says, the gas company is a robber, does any gas company make any attempt to contradict it? They laugh at him. That convinces him that they must be. He says, you are monopolists, you have everything your own way. You know it, it is a thing you should keep in the dark as far as possible, and modern business methods today demand keeping it in the dark. But a man comes up and says, you can make gas for ten or twelve cents. Somebody says, you cannot deny it; but a half-truth is, in all cases, more venomous than if it all comes out. If you tell a man that the volume of business which you do as a gas company in relation to the capital invested in the business is from one-twentieth to one-thirtieth the amount of the ordinary customary business, he will look at you with a blank stare. Now, how many companies are there in this state, whose gross receipts in three years will equal their capital stock? Let me not say their capital stock—Mr. Cobb is smiling over that—the actual amount of cash invested in the business. There are not many of them. Now then, take

any retail or wholesale business which does not turn over its capital stock four or five times in a year, and they would go to the wall. Their mains and investment charge, and legitimate interest charge is just as much the cost of our gas, as it is to put it in the holder. If a man comes in and says, it costs ten cents to make gas, he is right as far as he goes, and if he stops there he does the gas company an injury; but what gas company gets up and says he is wrong, and starts in to educate the public, and wherein could one gas company alone do it? Now, as to keeping all this matter quiet. In various ways we have gotten to our present condition, because we have never said anything in reply. What is going to be the condition if nothing is said for the next ten years, and the public is continued to be educated in the false ideas, and half-truths that are prevailing with respect to public corporations? It will be a storm that will just simply knock the whole of us out. On the other hand, if you start in systematically and carefully—you do not need necessarily to give your whole idea to the public at once—but you begin to educate the public mind as to what is the true economic relation of a quasi public corporation to a municipality, and you are careful that you make no statement that is not warranted by facts, and you do not make too many statements at once, everybody fly off and get to talking, and you will have that carefully watched over by a competent executive committee, that committee to do nothing unless it meets with the approval of the companies, as a whole, something which they propose to make public, and there will probably be six or eight months to educate your own members, to begin with, you will greatly counteract these things. If you were sick and let it go until you get a high fever, you have to call in a doctor, and you have a good deal of trouble in getting well, and maybe you do not. If you take corrective measures when a thing begins to manifest itself, and they are taken along conservative lines, the probabilities are that you will check it. The same thing will apply to our own business. I could multiply examples indefinitely; but the fact is, we have gotten to this condition because we have absolutely neglected all the symptoms. If we keep on we are going to be in trouble. The longer we stave it off, the worse it will be, and the harder it will be to get out. The time will come, if things go on as they are now, if gas companies want to have any immunity at all, it has simply to go out and buy its immunity. For my part, I would rather spend the money educating the public and fight for what I thought was right than I would in contributing tribute.

Mr. Persons—I believe the statement that especially in small towns, "the community is against the gas company," exists only in the minds of the people directly connected with the gas business. I do not believe that bad feeling exists in the minds of

the public. The whole thing is a mystery to the consumer. You cannot educate them, the mystery of the unseen, you cannot even teach them to read a meter. If you were to start a school, you could not educate five people in a town to read their meters. They do not take enough interest in it. You are selling something that is invisible, and it is a mystery to everybody, and people will naturally say, oh, we are being robbed by the gas company. But you talk to these same people individually, and they admit that they are perfectly satisfied in most every case. There are cases of poor service—there are not so many now as there used to be—but I do not believe that the feeling is bitter against any gas company in this country today. In the large cities the people and newspapers have attacked the gas companies, and demanded lower rates.

Mr. Persons—Mr. Butterworth said that the newspaper bureau sent out through the press very carefully compiled articles about municipal ownership. We should educate the people up to a point that they believe that they can see there is a different part to our business. I do not believe communities are against the gas companies.

Mr. Lathrop—On that line, I think we had as good a chance to demonstrate the fact last winter in Detroit, that people are not as a general thing antagonistic to gas companies. Along last January there was a lot of agitation came up as to the quality of gas we were sending out; and members of the council committee asked if they would furnish cards, we would address them and deliver them to our consumers, asking them to send their opinions, and any complaints they had to the city clerk. We sent out something over 52,000 cards, and at the time of year when we would naturally expect most complaints, in the month of February, when frost effects occur. Approximately, 1,100 of those cards were returned to the city clerk out of 52,000, a little over one per cent. Of that 1,100, 250 were commendatory of the service we were giving. That left something between 800 and 900. I would say that we investigated every complaint that came in, and sent men over to the city hall to get copies, and of those 800 or 900, a very large percentage of the complaints were from people who had broken mantles ,and things of that kind; so that when it finally came down to the question as to whether there was any general complaint against the company there were but very, very few who had any valid complaint, a very small proportion, possibly one and a half per cent, say, of those who did complain. I do not believe that there is a general complaint existing against companies today, which we have been led in the past to think there was. I think any business in any of our cities will have a larger percentage of complaints from their customers than the gas company.

Mr. Cobb—Mr. Persons suggest that a preliminary report be made by the committee before we leave Detroit. It strikes me that the subject is so large, and covers so much ground that it would be very difficult for the committee to make a preliminary report. I think the report would be very much hurried, and would not go into the thing at all the way it should be. A great deal has been said about strike, and what to do with municipal ownership. It is quite a problem. Small cities, and large cities, and the antipathy and antagonism against the gas companies. As Mr. Lathrop said, it is more newspaper antagonism, and mere political gossip of the agitator who wants to make capital out of it. I do not think there is any semi-public business today that has as little complaint and as little criticism from the public as gas companies throughout the country. The street railroads,—why they get it all the time. Look here in your own City of Detroit. It doesn't make any difference how good service you give them. Still at the same time, that in a certain measure is caused by the newspapers, and the political agitators. Right today, in Michigan, some of the best men we have in the State are advocating primary reform, which will mean that our newspapers will run the whole business. That is another thing. That our Association can get mixed up in to very good advantage.

Mr. Knight—I very much fear that all this will be talk, there won't be very much of anything done. How would it be to take two or three questions that are very vital, and say to this committee you shall deal with these this year. Take the question of municipal ownership, franchises and taxation. Now, I agree with Mr. Lathrop that the majority of citizens are not opposed to the gas companies. They do not feel bitterly towards us in any way, but they certainly do feel that there ought to be some consideration for it when a franchise is granted. A large majority of the people feel that way. I am not sure, but I feel that way myself. I am connected with a gas company which would like to have a franchise now; and I know that the matter could be presented to the citizens so that it would appeal to them as being entirely in their interest to grant it; and yet, if I should apply for that franchise now there would be a part of the city council that would want us to pay a lump sum for it. There is another portion that would want us to pay a certain percentage of the gross receipts. There is another portion that would want us to submit it to a vote of the people. Now, there must be some right way, some best way, a way fair to the citizens and fair to the gas companies. That is the question that we ought to solve, if possible, so that when we present our application for a franchise we can do it in terms that we can defend as fair and right, both to the citizens and the company, and then I think most of our troubles will be at an end. As it is now, we ask for more than

we expect to get. The city council demands more than is fair, and we are all at sea.

On the question of municipal ownership, we say that a city cannot run a business. We believe that, we know it, but saying it does not prove it. It is easy enough to come to the city where I live and prove that the city has invested $700,000 in a water works, and up to a few years ago they did not take in enough for water to pay the running expenses of the plant, and it was only by the action of some of the citizens who were deeply interested that we got meters put on, and all that sort of thing. We can prove that they cannot run an electric plant, and it can be illusrated in every city where they have attempted it. We can illustrate it without any question. Let us get the evidence together.

As to taxation. There are gas companies in this State who are paying more taxes than they ought to. There are probably some who are not paying as much as they ought to. There must be some basis to figure out what is fair and right taxation of gas companies. It is a very arbitrary matter now. There is no reason or justification for the assessments as they prevail in many instances. I do not think the people want that. They want what is fair, that is all.

I suggest that this committee take up those three questions and report on them next year; and I want to have it provided that they shall have funds. If there is any way to ascertain at this meeting what the gas companies will do, alright; if not, let us formulate some scheme of finding out what they are to do. That should be the first work of the committee; and then when they know, they can go to work and make a report on those three questions next year. I think that may result in some work being done.

Mr. Lloyd—I presume I am up to defend some of these statements. I should feel that I had entirely fallen short of accomplishing anything if I left the Association with the idea in mind that I did not think that public service by the gas companies was good, or if I left them with the idea that I considered the public at large was opposed to them. I know from my own experience that the individual consumers are satisfied. The public is not so difficult to satisfy if you will treat them properly. They are fair. Mr. Lathrop says he got a negligible number of complaints. Suppose that Mr. Lathrop today were up against the proposition of asking for a new franchise in Detroit. Would he go about his way and think it was an easy thing—there wasn't going to be any trouble about it particularly, even if all his consumers are satisfied. Now, in my shop, I know pretty well that I have no dissatisfied employees, no dissatisfied workmen. Mr. Knight is up against a proposition at the present time, when he knows that

the bulk of his employees are not dissatisfied with his treatment of them, or their compensation of their hours of work, and yet he has a strike on hand in an interest in which he is embarked. Now, it is the old question of the frog in the puddle making so much noise that you think it is a million. I think I am right, Mr. Lathrop, in saying that the Detroit City Gas Company trouble has not been so much from the individual disgruntled consumer as from the learned attorney here who serves the city, who has said that the gas company has absolutely no right to sell gas at two prices. Isn't that right?

Mr. Lathrop—Practically.

Mr. Lloyd—Now, these men who are in politics and make politics out of our business, do it because one way or another, directly or indirectly, it is going to abstract funds from us. We mean to pay them no tribute at all; but if we do not pay them tribute we have to pay some tribute to fight other influences, and they get into the limelight of publicity and pose as friends of the people by attacking any corporate interest that they can lay their hands on, street railway or anybody else. My point is, if we do this general education, as Mr. Knight suggests, and Mr. Butterworth proposed last year, that there should be some general press information disseminated. That is precisely what I want to get at. But you can not do it as a single company. You have to do it as associated companies, and it is for the benefit of all the interests in this State, or operating under the laws of this State. That is the only reason why I think that the Associaion should be confined to Mcihigan and to those operating under Michigan law. When we get that general information disseminated they are not going to find that the stirring up of the gas companies is such a profitable occupation, and they will divert their attention to somebody else, or else they will find some other outlet for their activity.

I would say, in respect to what Mr. Knight says, that I would propose specializing or limiting the proposed committee to an inquiry on any particular line, such as franchises, or municipal ownership, or anything of that sort. You will find that it will not be difficult to conduct any line of inquiry when you get your organization on general lines put together. That is the first thing you must do, because until you get your gun and your ammunition you cannot do much shooting.

Mr. Douglas—I was simply going to make a motion to bring this to a head, that the Chair appoint a committee of five ,whose duty it shall be to outline a plan, first of definite organization, and to report to the members of the Association, through a circular letter as early as possible. I make that as a motion.

Mr. Persons—I should amend that by suggesting that the

Executive Committee, as it stands here, constitute that committee, with one other man, whoever they may select.

Mr. Douglas—I hardly like to accept that.

Mr. Persons—I want to get Mr. Lloyd as chairman of that committee. You are all close together here.

Mr. Cobb—I second the amendment.

Mr. Lloyd—The Executive Committee might be more or less indefinite.

Mr. Persons—As it stands printed here.

Mr. Cobb—This year's Executive Committee.

Mr. Persons—I think they are in a better condition to handle that than anybody else.

(Amendment put and carried).

Mr. Lloyd—The original motion is also carried. The committee is Mr. Lloyd, Mr. Wolff, Mr. Douglas, Mr. Barthold and Mr. Knight.

Report of the Committee on Standard Sizes of Coke and Each Producer's Market Therefor

AS PROVIDED FOR THE MEETING OF THE MICHIGAN GAS ASSOCIATION IN DETROIT ON SEPTEMBER 20, 21 AND 22, 1905.

Signed by the Committee,
ALONZO P. EWING,
IRVINE BUTTERWORTH,
ROYAL SHACKLETTE.

From the heading of this paper it is readily seen that it comes under two heads: First, "THE STANDARD SIZES OF COKE," and second, "EACH PRODUCER'S MARKET FOR HIS OWN COKE."

More money is represented in Gas Coke as a residual of Gas Companies today than in all the other residuals put together. It seems essential that every care should be taken to make and protect its market. In preparing the market for a permanent and lasting consumption, I believe that one of the first considerations is to decide upon the sizes and relative names as compared with Hard Coal.

In finding a market, Gas Coke must for the most part displace Anthracite Coal as used for domestic purposes. The domestic user has ordered his Hard Coal for years back either as "egg," "stove" or "chestnut" coal, and in our endeavor to induce him to use Coke in place of Hard Coal, the first question asked is: "What size of Coke will compare with the size of Coal I have been using?"

If, therefore, we can screen our Coke so that the sizes will compare for general use with the sizes of Hard Coal, we will save ourselves some little explanation.

In Michigan it is our general belief that the Companies as a rule use the screen bars in making their Coke screens instead of having either a round or square mesh screen. We will, therefore, in making figures as to what the sizes should be, assume the use of bar screens.

In common use they are of two sizes: 1¾x⅝x5/16 and 1¾x½x¼. The second size is heavy enough for general use and for the smaller Companies.

Coke is much lighter than Hard Coal and as it does not feed as well in magazines and is more likely to clog, it is recommended that the screens be of smaller mesh in order to have the sizes of Coke a little smaller than Hard Coal when used in base-burners and ranges.

For furnaces the public demand varies in that some want as large Coke as may be had and others prefer the smaller because it is more compact in the fire pot and retards the draft.

Coke is handled very differently from Hard Coal. It does not need the amount of draft that Hard Coal needs and the furnace bars should always be covered with ashes and the draft obtained by poking rather than by shaking the furnace.

We mention but a few of these differences to show why Coke should have a different size screen than Hard Coal. The Hard Coal sizes as made by the different mines vary, but a fair standard will be those of the Pennsylvania Company, which are as follows:

"Egg Coal is that Coal which passes through a 2⅝" screen and over a 2⅛" screen."

"Stove Coal is that Coal which passes through a 2⅛" screen and over a 1⅜" screen."

"Chestnut Coal is that Coal which passes through a 1⅜" screen and over a ¾" screen."

If we are to make our Coke a little smaller we would recommend that all Coke that passes over a 1¾" screen shall be termed "Egg Coke;" that Coke which passes through a 1¾" screen and over a 1" screen shall be termed "Stove Coke," and all Coke that passes through a 1" screen and over a ⅝" screen shall be termed "Chestnut." These figures refer to the distance between the screen bars.

Experience shows that the so-called "Coke Breeze," provided it is not too fine, may readily be used for boiler fuel and also for fuel in water gas generators. For this reason some of the larger Companies have decided that it does not pay to screen out the "Chestnut Coke." The demand for this extremely small Coke is limited and as there is extra labor in screening and as the "Breeze" that is produced by this last screening is of materially less value than "Breeze" with the "Chestnut Coke" left in it, we believe that where this kind of Coke is used by the Gas Companies as boiler fuel or in generators, it may not pay to take out the smaller Coke, and only two larger sizes might be prepared for the market, unless there should be an unusual demand for the chestnut size.

In a number of the Cities in Michigan, Coke has been termed "Furnace," "Stove" and "Nut," and the customers are becoming accustomed to these terms; but, if we adopt the names "Egg," "Stove" and "Chestnut," we believe the customers will readily adopt these names and the dealers will be better suited.

With standard names and uniform sizes stove manufacturers would be much better able to build base-burners which would prove satisfactory to coke users.

With a standard of sizes and uniformity of names, all manufacturers would be benefited. The large Company in its advertising helps the small Company, as the leading papers have large so-called county circulations.

The people from the small towns make up the population of the large cities, and if they are educated at home to buy Coke and find the same nomenclature in the cities the trade is not diverted into other channels.

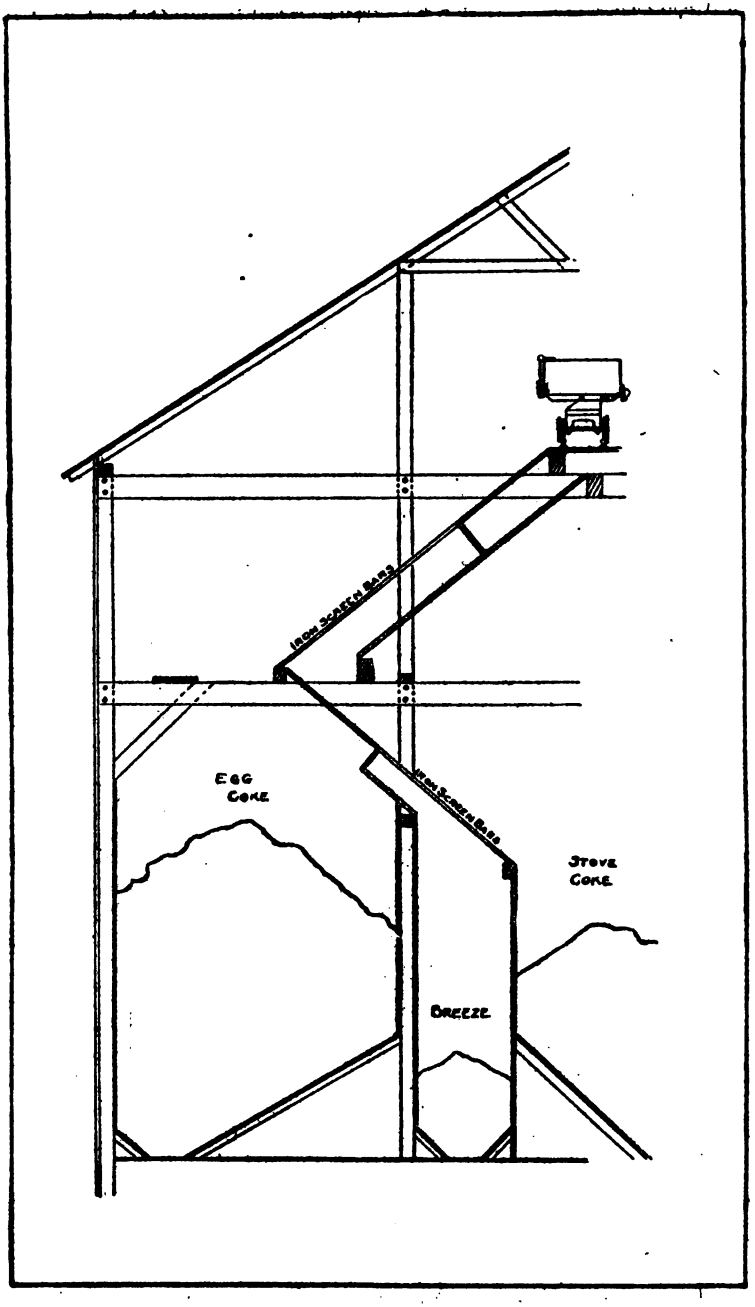
SECOND: THE PRODUCER'S MARKET FOR HIS OWN COKE.

It is a difficult matter to make a statement as to just what amount of Coke the various markets can use in proportion to the production in that particular market. For instance, in the largest city in Michigan in 1904 more than 75% of the total production was sold locally and in addition other makers sold in the same city about the same amount of Coke as the Gas Company. In another large city in Michigan, in the same year, about 98% was sold locally. In one of the smaller cities not only all of their Coke was sold locally, but a considerable quantity was shipped from other markets; while in a city of 25,000 in Michigan we have no figures for 1904, but in the year 1903 they marketed only 27% of their total production in their own city.

From such information as we have been able to gather, we believe that with the proper amount of energy expended each Company should be able to dispose of more than 75% of all its own production in its own city. The balance should be sold in its own part of the State. There is no necessity for sending Coke a hundred miles away when each manufacturing center has plenty of small towns in its own vicinity that could and would use Coke as a domestic fuel if proper efforts were expended along educational lines.

Coke is distinctly a domestic fuel. It has qualities that recommend it to every house-holder and if furnaces and base-burners are purchased that will use one of the sizes of Coke, it can be used to better advantage and with greater economy than Hard Coal.

Recent tests at the University of Michigan showed that Coke



free from moisture contained more heat units than Hard Coal and practically the same number of heat units as Soft Coal.

We would recommend that should any of the various makers in this State have occasion to ship into any of the markets in which a Gas Works producing Coke is located, both would be best served if inquiry were first made as to the prevailing market price.

In the past year there have been instances in which coke was shipped by gas companies to other cities having gas plants and there retailed by dealers at 50 cents less per ton than was obtained in his home market. Coke unlike gas is an open market product, and conditions, not inclinations, regulate prices. The difference of this course was that cutting the local retail price hurt the business rather than extended the market. There seems to be little room for doubt that had the difference in net revenue been expended in advertising, the total product could have been sold in the home market and a lasting trade built up and that without detriment to the gas company at the receiving point, which is undoubtedly just as anxious to build up a staple trade as the shipper.

DISCUSSION.

Sept. 20th, 1905, 3:40 P. M. (S. T.)

Chairman—I think that a rough summary of Mr. Ewing's report would be that everybody ought to sell all his coke in his own bailiwicke, and a little more. If there is anybody thinks that they ought not to, I think we ought to hear from them. This question of size, it seems to me, to be one that is not a case of local conditions, but is one in which uniformity could very well be effected by all the companies in the State. The paper is open for discussion, and I hope it will have a thorough one.

Mr. Douglas—I would like to ask Mr. Ewing—there is no scale shown on the drawing of the coke screen which he presents wit hthe report. What is the best height for that screen, and how long those screen bars should be?

Mr. Ewing—I think possibly Mr. Dewey can give you the exact length of these screen bars, because he is closer in contact with it. As I remember it, the bars were 8-feet bars, and are put in at about an angle of 45 degrees.

Mr. Dewey—I do not remember the exact figure. It is only a short time those figures were gotten up. I do not believe they are quite eight feet long, though. If any one desires to know that information exactly, I would be glad to get it for them, and give it to them tomorrow. We have it in detailed drawings.

Chairman—A screen about 8 feet?

Mr. Dewey—The screen bars, they vary in length. The furnace bar is longer. I would be pleased to get the whole information. If you want it, Mr. Douglas, I will get it for you.

Mr. Douglas—I would be glad to have it, Mr. Dewey.

Mr. Dewey—Alright, I will hunt it up for you.

Chairman—Mr. Frazer, no coke for sale out there at Grand Rapids?

Mr. Ewing—I would like to hear some opinions in regard to the names, because a good many have said to us they thought we should adhere to the same names we have always used; there was no reason for change, and as we have recommended a change from some of the others to a standard name, I would really like to have some expression of opinion, and I would like to have an expression as to what the coke condition is today, who has more coke than he can sell in his own market.

Mr. Knight—I think that the suggestion of adopting the names "egg," "stove" and "chestnut" is a splendid one. I think that is fine. We have not any more coke than we hope we can sell. It is not time yet to tell. I would like to ask Mr. Ewing about this last paragraph in this paper. He says: "In the past year there have been instances in which coke was shipped by gas companies to other cities having gas plants, and there retailed by dealers at 50 cents less per ton than was obtained in the home market. Coke, unlike gas, is an open market product, and conditions, not inclinations, regulate prices. The difference of this course was that cutting the local retail prices hurt the business rather than extended the market." I do not quite seem to understand that. I want to know if Mr. Ewing thinks it would have been better for the gas company who did that to reduce the price of their coke and sell it in their own town, and wouldn't he prefer to sell his surplus in his own town, assuming that he could sell it if he reduced the price low enough. What would be your judgment about the advisability of doing so?

Mr. Ewing—First of all, I do not think it is necessary for him to sell it out of his own market. In the next place, I think that he should have obtained the same price in that foreign market that the local company was obtaining. There was no necessity for his making room for coke, because he really did not. If there was room for the coke he could have sold it at the other fellow's price, because it had to be consumed; and if we are going to use markets near by us as a dumping ground, I think we should extend to that company the courtesy of letting them know that we were going to put in some coke there, that it would not hurt their condition at all, because if you can say to a man that you have an opportunity to put a few cars in his market, with no damage to his local trade at all, it is not going to affect him; it may be the best he can get himself. I have in mind, Adrian,

for instance. There is one dealer that buys coke outside of town; he does not buy much, but he insists upon buying that little out of town. We might just as well get the same price as the local company is charging. We gain nothing by cutting the price. That is why I say that I would add that 50 cents a ton to his price and spend it in advertising at home. The next year he would not have that coke to send down there.

Mr. Knight—I understand that there are some large gas companies which job out their coke—sell it to some dealer who guarantees to take it all and sell it at some price—I suppose at a profit. They have at times been bothered to get rid of it, and they have invaded the local market where gas companies had coke to sell and prevented their selling all their coke and maintaining a decent price. It is unreasonable and unfair to do the thing which you say has been done here; and the simple result finally, if carried clear to the end, would be one man shipping his coke to the market of the other, and he shipping back, a very bad condition of affairs. The question is, how can a gas company sell its coke in its own town at the best price obtainable, and sell it all, provided he can sell it all, unless he reduces the price and make it an object to the people to use it. Some people won't use it at a slight difference of price. I think we ought to put an attractive price on it. It was not a very satisfactory sentiment we aroused in our town when we shipped coke out of town for less than we were selling there. I was rather opposed to doing it.

Chairman—Do they burn anything but slabs up in Saginaw?

Mr. Cobb—Saginaw and Bay City, we burn a few slabs, and it is pretty good fuel. I think Mr. Ewing spoke about shipping around the State to other towns. I think that happened more than two years ago than it did last year, caused no doubt by the slowness of the fuel market. I know that we sold coke in another man's territory, and I know the Detroit Gas Company did the same thing, because we had some of their coke up in our town, and we know where it is. Last year I do not think that any of the gas companies around the State had any such trouble at all. Do you know of any last year?

Mr. Ewing—I had a few letters in regard to it last year.

Mr. Cobb—Your names that you have selected, egg, and stove and chestnut are just the same. The only change in that is the word, chest and nut. We always called it egg, stove and nut.

Mr. Ewing—Nut coal is smaller than chestnut.

Mr. Cobb—It means the same thing. It would not mislead. Others call it chestnut, we call it nut.

Chairman—What is done in Grand Rapids; we have had a State Fair out there; did you warm up the grounds with coke?

Mr. Cantrell—I will have to tell you a good joke about that.

This came to me as a story. They had an exhibit there at the State Fair, and for some reason or other the stove that was installed there did not have sufficient draft. There was something wrong. The coke was put in there, ignited, and started to smoke, like to have smoked everybody out of the grounds to start with. There was quite a josh about it for a while, until they got the damper on. In Grand Rapids they market practically all the coke locally. The officers of the company very much favor the adoption of these three different terms for sizes; from what I have heard them say they are very much in favor of it to comply with the same size sof hard coal.

Chairman—Mr. Stirling, did you get rid of all your coke?

Mr. Stirling—Yes. We do not know anything about crushing, for we have a market for all of it without crushing, from the retorts.

Chairman—Is there any sold in town outside of what you make?

Mr. Stirling—Very little. The Detroit company shipped some over two years ago.

Mr. Freese—I have not much experience in the coke line. I know that the coke propositions of some companies seems to be a hard one. The plants at La Porte, Ind., I know they are piling up their coke in great piles. I could not give you much information on the subject of coke.

Mr. Douglas—I want to agree with Mr. Knight in that I think every company should market practically all of its coke at home, and market it a price where it can sell it at home. The market should be studied, and that price adjusted so as to compete with the other fuels. I do not believe it is just; I do not believe it is good policy to charge one price for your home consumption, and another for your shipments.

Mr. Lathrop—If any of you gentlemen want to see some really good coke, and lots of it that is going to be marketed locally, we would like to have you come down while you are here and see what we have down there. We intend to market it all over.

Chairman—You are interested in the production of coke as coke, rather than gas, Mr. Blauvelt?

Mr. Blauvelt—I suppose probably our coke gets out of the city, and no particular city has been used as a dumping ground. It has been sold through lical dealers, and they base the price on what Detroit dealers pay. At the present time coke that is shipped to the outside market is bringing better price F. O. B. our yard than the coke we are selling in Detroit, which is a very satisfactory condition of affairs. I think this coke market business has never been worked up anything like it should have been. I don't think the Detroit Gas Company has half as much trouble

in marketing coke as before the Solvay Process Company came into the market with a tonnage rather more than theirs. I know that the Solvay Process Company last year was able to market locally, and at a satisfactory price, a much heavier tonnage than they did the year before, and our stock piles at present are very much less than last year; and also made up of the sizes which are marketable at a fair price. In regard to those sizes, our company uses different sized screens. We screen with a rotary screen, as we find it pleases our customers rather better. There seem to be certain advantages in the use of the rotary screen. Our sizes, after passing through the crusher, are made up as follows. I may say, we make three sizes, egg, nut and pea. We find the market for stove is rather small. The simple result was we shipped, about a year ago, some 6,000 tons of stove coke which we had great difficulty in disposing of. This year we have the same quantity of coke, but it is all nut coke, and it is going out at this time of the year faster than we can make it. We reduced our stocks in the month of August. We have just held our own thus far in September, and we have reduced our stocks a good deal in egg. Our nut coke is what passes over a ¾ inch, and through an inch and a half. Our pea passes over a ¾ and through a ⅜. That gives us a size which does not compete with anthracite, and does compete with soft coal, and is sold at retail at about $3.50, and is used quite extensively in the Polish and Hungarian settlements. Our egg is anything that passes over a one and a half square opening. Our breeze, up to a very recent period, has all been shipped into western markets, principally Chicago, where it has been used by brick makers, and zinc furnaces and so on; and we got about the cost of handling out of that. We are now building a plant, and as in the experimental stage, we have turned out twenty or thirty tons of brickettes; we will have a capacity of about five tons an hour, and we will take care of all our breeze, and if the market for brickettes is suitable, we will crush up the pea coke and turn that into brickettes. I don't know as I have anything more to say; but I would like to say the same as Mr. Lathrop says, if you want to see some *really* good coke, we will show it to you at the Solvay Process Works. (Laughter.)

Chairman—I think it might be interesting if you would give an outline of that brickette plant and the product. It is a new thing here.

Mr. Blauvelt—That brickette plant is yet somewhat undeveloped. Instead of trying to work entirely on original lines, we took up the study particularly to find out what had been done over where they had coke breeze as their staple, which had to be disposed of. The only machines which we could find any record

of working successfully was an English press, which made a large brick about 6 x 9 x 3½, I think. There was a press in Scotland using eight or nine per cent of coal tar pitch, about 25% of coke or coal, the balance made up of breeze. We realized that we could not get the American householder to use a brick that was as big as a Webster dictionary, to go down cellar, crush it and throw it on the fire; and we had to insist upon smaller brickettes; and the brickettes we have made are three inch cubes. They are made under very heavy pressure, so that the density is almost the same as anthracite. Thus far, we are not on the market, but we have made a few tons, and we are experimenting in stoves and furnaces out there at the works. It looks to us as though it would market at very close to the same price as anthracite. We want it to be so that it wont hurt the coke market, and will give us a means to get rid of our breeze. We find by using a binder pitch which has practically no ash, and the soft coal which has only about three and a half per cent ash, we can get the mixture down where the ash is about ten per cent, which is about the same as anthracite coal. I have some samples in the laboratory to have calorific determinations made from, and I think it wont vary materially from anthracite. My own opinion is, that our brickettes are a little bit large except for large house furnaces; but my hope is in the future we can change our moulds and use a 2 inch cube, and that would replace egg coal.

Chairman—Do you anticipate any breakage through the use of a cube?

Mr. Blauvelt—The thing that has surprised us much has been the small amount of breakage. They are delivered on a coal conveyor about 200 feet long. By the time they get 50 feet from the building, we had a wagon located there, and a shoot that was about 12 feet long, and at an angle of about 45°, and struck in the wagon that was located there. I don't think there was half of one per cent breakage when the machine was working. We can take and throw them against the side of a house, or around on the floor, and hardly anything break. The corners are champered in a machine. If they were sharp corners they would break. I don't think the breakage would be any more than anthracite coal with the ordinary handling.

Chairman—It seems to me in this question, a market for coke, that it is very much the same as other classes of merchandise, and that in dealing with the subject, we have got to divorce our minds from any preconceived ideas in the disposition of gas. The idea of maintaining a price, we will say, at a fixed price, agreeing on a price or anything of that sort, never seems to me will work out, when it comes to what are open market products, absolutely. I think we are at liberty to sell our coke at

any price that we may see fit; that is to say, it is a different character of service altogether from the delivery and sale of gas. There is no question in my mind that each market, not only can, but ultimately will, absorb more coke than can be produced in serving that community with gas. It is going to cut into the hard coal trade in this section of the country. There seems to be no disposition to reduce the price of hard coal, the quantity of it seems to be more or less limited, and there is a market for all which the owners of those properties care to produce in any given year, at those prices. Now, there is a growing sentiment against the destruction of the beauty of our cities with the smoke nuisance. There is the further fact that the old methods of coke producing are all going to be superceded. The old beehive processes are going to be superceded. It does not make it look beautiful for the tar market, and probably it is in as bad stead as it can get anyway, but as soon as this coke gets on the market, it will curtail the domestic use of soft coal, and there will be a tendency to curtail the use of it in office buildings, and all places down town; and I think there is going to be an enormous extension of the use of coke. I think we are only just scratching the surface at the present time, of the quantity of coke that a community can absorb. Now in some communities, where they have been hammering away at the proposition for a long time, they have spent a considerable amount of money in educating the people; they have carried on a campaign, which it has even been suggested at first was worth money from a capital standpoint. In other communities they have not developed their market to the same extent, they have not got the people to use it; they have been accustomed to hard coal, and they are still burning it. There is very little difference, as far as I have been able, personally, to observe between furnace coke and hard sirable. If that be the case, it is only a question of educating coal, and at a very moderate difference in price, coke is more desirable. If that be the case, it is only a question of educating a community until they are going to use this product. If a company has been making, let us say, water gas for a number of years, and the people have been accustomed to heating their houses with hard coal, it is going to take some time for them to become accustomed to a change in fuel, and that company for some years at least will have more coke than it apparently can dispose of, locally. Under such circumstances it seems to me, a company might as well make a low price locally as to dump it in some developed territory, because the farther they go, the worse off. If they ship out of town they are selling at a low price, because there is the freight and dealers profits against them, and that condition will continue; whereas if they

will educate their own market, and sell it at low prices, and get the people using it, gradually they can run their prices up, being under no obligation to maintain a low price. When they get the demand, they will get higher prices, because it is an open market product. If they do not want to buy here, they can buy it somewhere else. It is not like gas.

TAR BURNING IN GAS AND ELECTRIC PLANTS.

THE ROME GAS, ELECTRIC LIGHT & POWER CO.

There are probably but very few tar producing plants in the country that have not at some time made a more or less thorough attempt at burning at least some portion of their product.

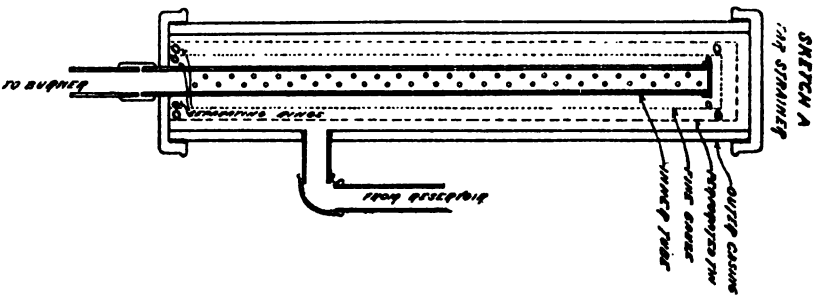
Some few have reported that they were satisfied with the results obtained, but when an attempt was made to find out what they were doing and how they were doing it, the available information began to narrow down remarkably, until the seeker after knowledge was generally forced to content himself with the most incomplete descriptions of burners and methods which, when they came to be put into operation in his own plant, failed to show the desired results, and after making such changes as suggested themselves without getting any nearer to the desired end, the matter was in most instances allowed to drop and the sticky fluid continued to accumulate until in many small plants the tar wells, any extra tanks that the works might possess, all the barrels they could store, and finally the holder tanks were filled with tar.

To come down to our own experience, when it became impossible to find a market for our tar, unless we were willing to sell the entire yearly production at 1½ cents per gallon, we began to talk seriously of trying to use it for bench fuel; an idea which was fostered by the fact that we had built up a very fair market for our coke.

Our foreman, an intelligent young Welshman, with whom we took the matter up, grinned and remarked that when he first came to the plant they were burning tar very successfully, so far as getting rid of it was concerned, in fact, it burned fine, but it took rather more coke than where the benches were fired without it, and when they burned it under the boilers it melted out the grates and the coal consumption was as great as though no tar was used, but still he was quite willing to try any scheme that offered a fighting chance of preventing our being buried in tar.

After going around to three or four plants where they were burning tar, we found that "were" was the proper word when it applied to some time in the past and all we could unearth

were parts of piping schemes, bad burners and disgusted foremen and operators, and the net result of our looking around simmered down to the conviction that the majority of the failures was due to the fact that in most works tar was tar and that whatever effort they expended was always along the line of arranging piping and buying or devising burners with little



or no regard to preparing the tar so that it would flow smoothly.

We started by building two strainers (see sketch A) as follows: Two 18″ lengths of 3″ W. I. pipe were cut off and threaded on each end. A 3″ cap was bored in the center and tapped for a 16″ length of 1″ pipe, which was bored full of ⅛″ holes and screwed through the cap from the inside, then the 3″ cap was made upon one end of one of the 3″ pipes which had been tapped to receive a ¾″ inlet about 4″ from the capped end. Cylindrical strainers, one of perforated tin and a finer one of brass gauze (such as is used for dairy screens), were slipped concentrically over the 1″ outlet, but were held from making contact with it or with each other, by rings soldered at their tops and bottoms. Then the top of the 3″ pipe was loosely capped to exclude dust but left so that the screens could readily be removed for cleaning.

One of these strainers was placed on the inlet of the tar reservoir and one between the tar reservoir and the burner. The tar reservoir was a steel tank holding 78 gallons and containing a small steam coil so that tar could be maintained at a temperature of from 100° to 110°F.

We had invested $15 in a well-known tar burner ("Parsons') in which the tar was brought to a central circular orifice by gravity and there it was supposed to ooze out into a circular jet of steam which surrounded the tar outlet; as an atomizer it was all that could be desired, the flame was smokeless and intensely white and within two hours the settings were dripping fused fire brick. Then the burner was tilted down and the flame baffled on a pile of broken brick thrown in onto the grate bars.

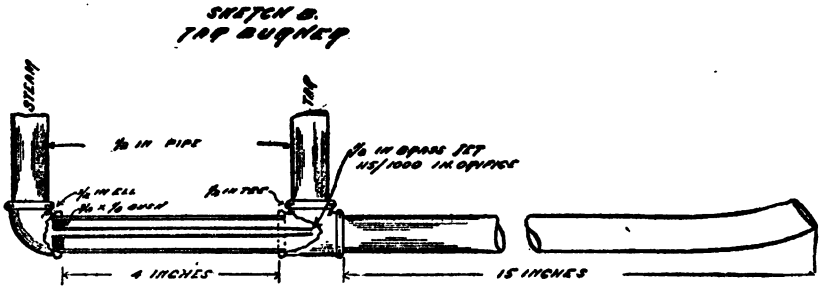
This gave a better distribution of heat, but, though we carefully experimented with the burner for nearly three weeks, we were not able to strike a combination that would heat the bench evenly and the yield per mouthpiece was correspondingly low.

The objections noted were bad enough, but added to this we found that in spite of the care with which we strained and maintained an even temperature on the tar, two men and a small boy could not keep that burner going and that in the face of all we could do it would stop up at intervals of from fifteen minutes to two hours.

In the burner mentioned, the flow of tar was regulated by a needle valve and, as we were cutting the consumption as low as possible, the valve was nearly closed and what tar did pass was forced into a very thin sheet surrounding the needle. Thinking this might account for its stopping, we carefully filed a slot of circular cross-section lengthwise of the needle, thus allowing the necessary amount of tar to flow in a solid body. This was a great help, but, as the burner did not operate on the syphon principle and there was no pressure on the tar except such as was afforded by about six feet of head, the trouble was not entirely eliminated, and as coupled with this we were unable to get anything like reliable operation, the results were far from satisfactory or economical.

As will be noted, the results obtained up to this point were entirely negative, but they have been given with the idea that it is frequently of value to know what not to do.

The first favorable results which we attained in burning tar were with burners which were built of pipe and fittings, and from



first to last, good, bad or indifferent, they have all operated on the ejector principle as this will largely eliminate stoppages due to slight changes in the consistency of the tar, and after many changes we have finally settled on the simple form (see sketch B) which we are using at present.

This burner can be built for 25 to 30 cents, including labor,

and is installed through the center of 4½" opening in firing door, which we have bricked up with exception of opening mentioned.

The burner never stops up, requires practically no attention and running the tar through one screen having 16 meshes to the inch is all that is necessary, as the burner exerts considerable suction and has no constricted tar passages.

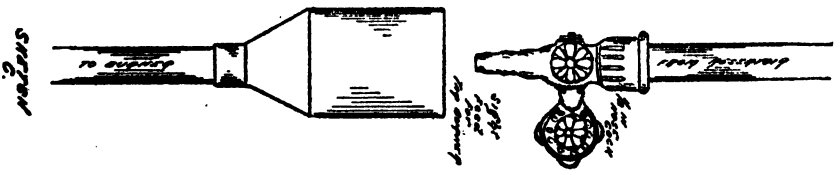
We are regularly carbonizing from 4½ to 5 tons per day of 24 hours with an average consumption of 138 gallons, or about 37 gallons per ton; on tests this can readily be reduced to 134 gallons, but the average running will show up somewhat higher.

The figures given are hardly fair to the tar burner, as we find that the men pick lump coal for the coal-fired benches and give the tar-fired bench all the fine or wet stuff that remains. This can be done as the burner seems to have no trouble in holding up the heats.

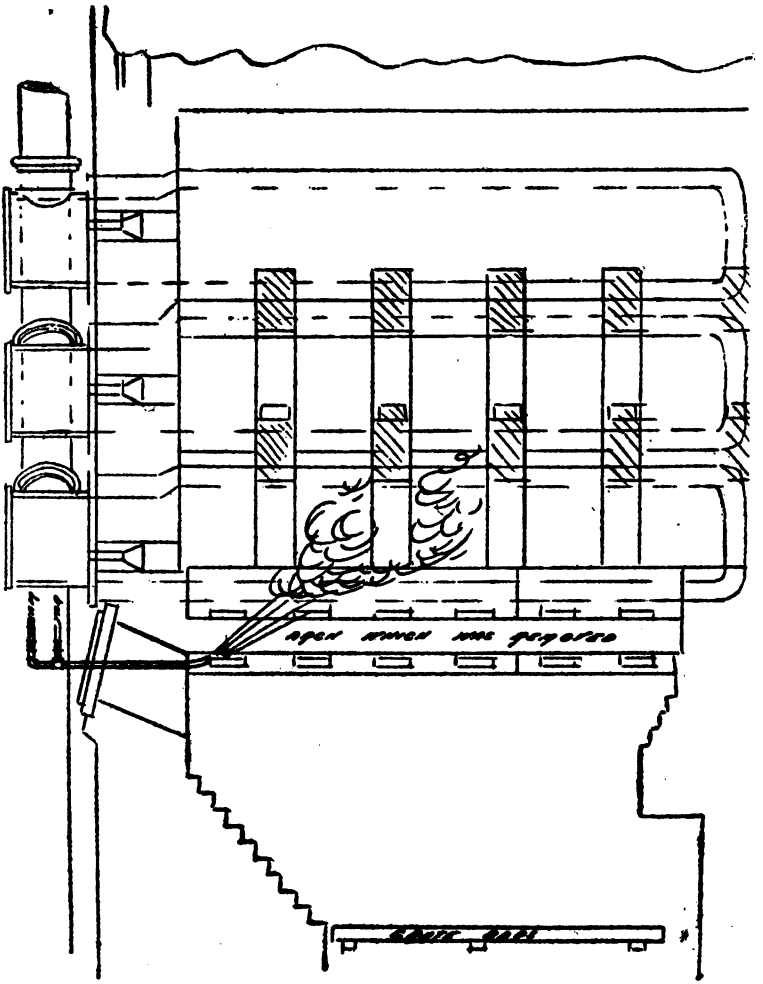
It may be well to note that in using this burner we found it necessary to get rid of several preconceived ideas. In the first place, we used about 220 gallons of tar per day in the endeavor to get a white flame and still keep up the heats. By reducing the amount of steam admitted, we found that the tar could be reduced and no cooling of the bench was noticed. This was kept up until the burner was doing better work on 138 gallons than it did on 220 gallons, but the resulting flame from which the most economical results will be obtained is far from white. In fact, it is a rather slow, reddish yellow, but does not smoke or soot up the setting nor is any amount of smoke perceptible at the stack.

The setting with which the experiments were made is a Parker Russell Co. Standard half depth, semi-recuperating bench of sixes. We removed the arch and directed the flame upward directly among the retorts and against the saddles at a point about three feet back from the firing door, the flame first appearing on line with the lower retort, but in four months' run there has been no sign of melting them down or in any way working undue injury to the bench.

The tar supply is regulated with a ½" stove cock as shown in Sketch C, as this enables the operator to observe the amount



of tar he is feeding. No breeze or other fuel is used and no fire brick is necessary to protect the grate bars, as the flame is



up among the retorts instead of being down in the furnace.

To burn tar in our electric plant a burner was constructed so nearly like the one which was later described by Mr. George Reed, of Binghamton, N. Y., in figure 15, page 570, American Gas Light Journal of April 10, 1905, and also on page 175, Progressive Age of April 15, 1905, that the description and drawing given will cover it, except that we used no fittings larger than ½" and did not draw down or contract the nozzle which was inserted through a ½" hole drilled in the boiler fronts above and in no way interfering with the firing doors.

The above arrangement made it possible to change from coal to tar at a moment's notice and in carrying a peak load we sometimes used both until we found that the tar burner alone was capable of making more steam than we could use.

The boilers are Class E. Sterling Water tube, rated at 202 H. P., having 2019 sq. ft. of heating surface and 42.66 sq. ft. of grate surface, stack draft about 6/10"

Tar used weighed 9¾ lbs. per gal. and the average evaporation was 12.82 lbs. of water per lb. of tar. This was largely due to an unfavorable load factor during several hours of the day, as full load tests indicated an evaporation of nearly 14 lbs. of water per lb. of tar.

The tar is pumped without any strainers whatever, direct from the tar well to the burners by a small Marsh steam pump working under a pressure of from 125 to 170 lbs. per inch. It will be noted that the tar pressure must be higher than the steam pressure used, and in our case this varies from 100 lbs. during light loads to 150 lbs. at the peak.

The flame is directed downward by bending the nozzle so that it will strike the grate bars about 3½ feet back from the furnace doors, where it is received on a bed of about 8" of ash, clinker, coal or breeze. The ash pit doors are left open and ash pits are filled with water to prevent warping the grates, but as there is very little draft through the mass of material on the grates the principal air supply is an over draft admitted through shutters in the firing doors.

The burners rarely clog and require a minimum of attention. Flame is one whirl of intense white, there is no smoke and the entire installation can be made for $5 per boiler, exclusive of pump, which in our case cost about $31 and is large enough to supply two boilers to their greatest capacity.

In figuring the fuel value of tar against any fixed price per gallon, it must be remembered that the price received is never net, since an allowance must be made to cover pumping, barreling and carting the product. In burning tar, these costs, with the possible exception of the pumping, can be entirely eliminated and even this may be done away with in firing

benches, as the tar can readily be taken direct from the hydraulic main to the burner by the installation of a simple tank separator provided with suitable overflow connected back into the main leading to the tar well.

A sketch showing a simple arrangement devised by Mr. F. C. Slade is shown on page 610, American Gas Light Journal of April 17, 1905, and though differing considerably from the one we are using will serve to convey the idea and will undoubtedly work as well.

DISCUSSION.

Chairman—Tar burning seems to resolve itself into whether you can get more out of it as fuel, or as a sale product. Mr. Barthold: The whole secret of burning coal tar is getting a smooth flow, and most attention must be paid to that end of it, getting it to go to the tar burner well strained and at the proper temperature. The next, it must be sprayed into the furnace at the proper temperature. In the benches you have the burners surrounded by incandescent fire brick. In most boilers you do not get this condition, but you do in the Stirling boiler, where we have an incandescent arch above and it is an ideal boiler to burn tar on. Any Dutch oven would answer the same purpose, but you must have the boiler surrounded by incandescent fire brick, as it must be at a very high temperature. We tried, I think, three patent burners for coal tar, and none were successful. We had to make up a burner of piping and fitting. I noticed that the amount of tar that we used replaced fuel at $3, at about 2c per gallon. The best you can do is to burn the tar, and taking the greatest pains possible, it destroys the benches very rapidly, and it is safe to say that it cuts its life in one-half, and that and the attention required, and extra expense about half a cent a gallon. We burned 500 barrels one year, and obtained about 3c a gallon for it. We deducted 5c from that for extra wear and tear on the benches and expenses. We always use coke with ours. Mr. Whalen at Jackson burned some tar, and the way he was burning it, I think he was getting the best results as far as wear and tear on benches is concerned. As far as I saw, it was not any harder on the benches than coke or coal, and he has had considerable experience on this subject; and also Mr. Traver, I think has had a good deal of experience in burning in boilers.

Chairman—What kind of a strainer did you use, Mr. Barthold?

Mr. Barthold—We had a measuring tank that held about

eight barrels, and it flowed from that to an ordinary barrel. This barrel had a float in it that regulated the inlet cock, keeping it a certain height, and that gave a constant head on the burner. This tar coming into the barrel went through several screens, and the barrel had a coil in it to keep the tar at the proper temperature. We use a wire screen. We first tried gunny sack, but it clogged up too quickly. I think we had several layers of ordinary window screen.

Chairman—You found no difficulty with tar going through ordinary window screen?

Mr. Barthold—Not with the home made burner. We use six or eight thicknesses of screen.

Chairman—You figure 2c a gallon, with fuel at $3 a ton. That is a fairly high price for fuel.

Mr. Barthold—$3 replacing coke or coal; that is a fair price.

Mr. Whalen—We used a tank that held about 300 gallons, I believe, and we have a two-inch pipe leading from that to four benches, and through that 2-inch pipe I had a quarter inch pipe that carried a small amount of steam through the two inches, and the feeders were taken off the benches, and this steam pipe inside kept the tar about the same temperature all the time. Then we had a strainer on the inlet tube from the pump. This tar fed into barrels upstairs where the operator could see it, and we had strainers, brass, regular wire screens on the top of those barrels where the tar went through. This prevented dust from getting down and plugging up the burner. We tried all sorts of schemes to keep that tar from plugging up. We had trouble in the fire box, that it would stop it at the end of the burner and clog up and not run, when we got it too hot or too cold; but by a small amount of steam going through the quarter inch pipe, it kept the tar at the same temperature all the time, and fed all right. Our trouble then was in the fire boxes. If you got the pipe too far in the fire box, the pipe would get hot, and the tar would pitch up on the end of the burner and clog up. I cut that off entirely and I used an open piece of ordinary pipe, and I put that right underneath the fire pot of the door, just extended the tar pipe through the wall, and it never got into the fire box far enough to get hot. We used no fuel at all but the tar. We used a little breeze, probably 100 pounds a day in each bench. This tar was scattered inside of the wall all along on top and in the arch box, but the pipe was out, and we had no white heat at all in the fire box; we had nothing more than a cherry red in the fire box; and I gave it a large amount of secondary air from the bench. This tar went through from the fire box, a regular smoke, and the secondary air took care of it after that. It did not affect the settings any, and we used

about 135 gallons for a day of 24 hours—that is about 100 pounds of solid fuel—but we could not do as well with the tar as we could with the coal fuel. The tar would not run as constantly and give the steady heats; we could not decarbonize as much coal. We would run about 2150 pounds on six benches for four hours, and sometimes the heats would be up and sometimes down. We could not run as uniformly with tar as with coal. I figured that coal at $3 a ton took about 300 pounds to the ton carbonizing the coal, and took a great deal more coal out of the coal box than the tar fire box, and I figured tar is not worth a great deal. To decarbonize a ton of coal we used 45c worth of coal per ton, and 37 gallons of tar. You would only have 45c of fire if you used 37 gallons of tar per ton of coal carbonized; and to use 45c worth of coal to carbonize, you have only 45c for 37 gallons. And we have extra labor attached to that, and there is some more cost to the bench. The bench won't last as long. I figured in all that your extra labor will cost you a cent more. Take the way he is using it four and a half tons of coal to five tons per day of 24 hours and compare that. Compare five tons of coal for 24 hours, with the 13,500 pounds of coal for the 24 in the coal fire box, your labor costing a cent and a half more, end add that on to the 37 gallons, and I don't think you will have much left, if you can decarbonize that coal for 45c.

Chairman—Mr. Whalen has gotten unusual fuel results, and he has carbonized six and a half to eight tons on a bench of six every day. Three quarter tube?

Mr. Whalen—Yes. That is comparing with tar fuel.

Chairman—That is certainly getting good results, Mr. Traver?

Mr. Owens—I found the greatest trouble entirely with tar burning was to get it to run constantly. If we can get something that will keep the tar running freely all the time, then we can get down the cost of it; we can use a great deal less if we can keep it going all the time. If running too fast, and you run it slower, the heats will go down, and you have to lower the charge and get them up again. If we can get something that will make the tar run constantly, a great deal less can be used, because when the tar stops running, the steam keeps going and clears the bench off. It is a matter of getting the tar to flow with a very small stream of steam. I believe 90 or 100 gallons of tar will decarbonize six tons of coal if we keep it going all the time. It is a matter of getting the tar to go all the time, where you get good results.

Mr. Schwarm—How long did you use tar?

Mr. Owens—About four months, I guess.

Mr. Schwarm—What effect did it have upon the benches?

Mr. Owens—None whatever on three, but it seemed to affect one, and I don't know whether I can lay it to the tar or not. It didn't hurt the bench, it never got around to the recuperators.

Chairman—Nobody else seems to have attempted to burn tar with the use of secondary air. This paper contemplates cutting out the arch and directing the flame up and making a plain setting out of it.

Mr. Owens—That was the same principle that I had; it went through those large openings in the arch.

Mr. Owens—Went through the ordinary nozzles from the fire box, and then we used my secondary air. My fire box was not over a cherry red. The heat went up through there, and it went right underneath the fire box and extended up, so that it pointed towards the center of the arch and went in a kind of half moon shape going in, and it all went up. There was no white heat in my fire box and in the arch.

Chairman—That seems to be different.

Mr. Douglas—We burned tar in two benches for about three months with very good satisfaction. They were not exactly the type of bench that Mr. Whalen used his on, but they were a bridge wall setting, and we used our secondary air all of the time. We cut out all our underdraft, and had everything plugged up tight, and while it was considerably harder on the bench than a coal fire would be, the result was not very bad, and they were in pretty good shape. We kept our heat very constantly. We did not have any trouble in carbonizing fully as much coal, about 315 pounds in four hours in the retort, about the same as we are doing with coal. We took our tar from the hydraulic main into the separator, but found that was not quite sufficient for the tar we required. We erected a steam pump from the tar well and pumped a constant stream and let it overflow. This kept it stirred up in the separator, and we used what was required from that, screening it through two or three screens. We tried several of those pipe burners, and one with fair success. They seemed to centralize the heat too much in one spot, and we finally went back to the old burner which my father designed some 15 or 20 years ago—for burning oil. They used to burn crude oil in their benches. It consisted of two castings of conical shape, and turned up on the points, so that the inner cone screwed up to the outer cone, leaving only about a 1/8 inch aperture. This formed more of a whirling spray, and seemed to spread the tar. We tried all the pipe burners which have been described in the journals, but none seemed to work so well as this old burner.

The way I burned the tar, and I guess the most of us, we

would get a white hot furnace and spray the tar in there, and the instant the tar got in there, it exploded and gassified, and burned instantly, right at that point. It was a different way that Mr. Whalen burned it. It shot in this fire box with just enough heat to vaporize it, and the tar went through the fire arch in the form of vapor and a thick smudge, and the secondary air came over and burned that air and vapor, and it is the only proper way to burn tar because you can burn it in that way without any detriment to your bench.

Chairman—Through the use of secondary air?

Mr. Whalen—I found I had no trouble at all. I do not believe there is any particular damage done to the bench with tar. I believe it will make good bench fuel, if we can get some arrangement that will keep that thing going constanly all the time. I had no trouble keeping the heats up. I had no heat when it went through into the recuperators except when the burner was stopped up and turned on too much tar, and then we would throw it free. There would not be too much for the secondary to take care of, and it would not burn. I had one bench that I experimented upon, and worked on entirely for several days. I have decarbonized 13,000 pounds in 24 hours on that bench with four gallons per hour, and just about 100 pounds of fuel; but that was a case where I kept it constantly going all the time. On the other benches, where I didn't do so well, I took over five gallons per hour, but it wasn't able to keep the heats up—a waste of tar.

Chairman—That is a low quantity per ton.

Mr. Tippey—I have not had any experience recently with burning coal tar; but we had a relief holder partly filled up with water gas, oil and tar mixture, and we burned that under our boilers, and fed the tar by gravity. This was used under horizontal tubular boilers, with latterly, the grate bars within six or eight inches of the bottom of the ashpit, and kept a coke fire on top of the grate, so that if for any reason the tar stopped coming for a minute it would be sure and light when it came again. I used the Snell burners most sucessfully. They were made in the city here, a brass burner, and very good for burning tar. At the bridge wall we built two four-inch walls, on each side of the bridge wall, with a space of a foot between them, and that was built like checker brick in water gas works, so that the combustion would pass through the checkered brick in the first wall and whirl around in behind and strike against the solid face of the second wall and deflect and go through the opening. By that means we were able to get smokeless combustion and had very good success, and only quit when the tar was all burned up.

Chairman—Mr. Blauvelt, haven't you some sort of spray burner in use down there, with liquid fuel?

Mr. Blauvelt—We experimented with the Persons and it worked very well. We did not have much trouble in plugging, but the great trouble was on account of the flame, which caused our fire brick to last only from three days to three weeks, and we had to give that up. Then we used the Snell burner, in which the tar dribbles down, while the steam issues in and makes a diamond shape flow—it does not come in with the jet effect, and it saves the wear and tear on the furnaces, which is not more than coal fired boilers. We used to burn a good deal of tar that way, about 20 tons a day. We found a market for some of it. Instead of using gravity to get the tar through the burners we used a system of compressed air. We handled most of the tar by compressed air rather than by pumping. A tank is filled and the air turned on and brought to the burner under pressure of 10 or 15 pounds to the inch.

Mr. Schwarm—I gain from the talk of the various members that the old theory about tar being destructive on the benches is not as much as we have been charging it with; is that your experience?

Mr. Barthold—The way I burned it, it is. The way Mr. Whelan burned it I do not believe it is as destructive.

Mr. Schwarm—It seems to me in communities where we can not sell our tar at a higher price than two and ahalf cents it would pay us to burn it, according to your method. I feel this about the tar proposition, that the condition of the market is such that the more tar we burn or throw in the river the better. The residue would bring a beter price, and it would be desirable from every point to burn it.

Mr. Whalen—I cannot figure how this gentleman figures his tar worth two and a half cents a gallon to burn it. I would like to know how he figures it. He said he can burn tar and obtain two and a half times better to burn it than sell it; I can't do that.

Mr. Schwarm—Those are not my figures here. Since this report was printed we have experimented further and got that consumption down quite a little lower, which makes it net about two and a half cents. We have experimented further, and it costs us about two and a half cents.

Mr. Sloan—We have experimented somewhat in Pt. Huron, and we did not succeed in preventing it from injuring the benches. I hope to experiment further with it. We injured our benches—that is, we experimented with old benches,—some that we had to renew anyway in a very short time and we used them up faster than if we had not put the tar in. We only renewed one, and it was only a matter of a few months' time when we would

have to renew it anyway. We had to use an intense flame. We did not succeed in getting as low a figure to carbonize. The reports that we got from the works always showed they used a good deal more tar than our inventory showed at the end of the month, so our measurements may have been higher than they should have been.

(An adjournment was then taken to 10 o'clock A. M., September 21st, 1905).

GAS ADVERTISING.

By Glenn R. Chamberlain.

The subject of advertising is such a broad and important one that I feel it rather presumptuous on my part to attempt a discussion of it that will be either new, interesting, or of any value to the Association. Therefore, in deciding to accept our President's commission to write such a paper, I must frankly admit that, in a great measure, I was guided by a remark once made by Mr. Emerson McMillin to one of his lieutenants in the gas business: "If you don't know much about a subject, write a paper on it."

The word "advertising" has been defined by some of the more "conservative" members of the gas fraternity as "a way of spending a company's money foolishly," and undoubtedly much of the advertising that has been done could well be described in that way. However, in connection with that opinion, we must take account of the fact that the amount of money spent in America for advertising is estimated at about $1,000,000,000 a year, and we all know that wide-awake American manufacturers and merchants are spending very little money foolishly. We are, therefore, rather inclined to prefer the definition of the man with the more optimistic make-up who, defining the word in a general way, says: "Advertising is a subtle, indefinable, but powerful force which enables the advertiser to create a demand for a given thing in the minds of the masses, or arouses the demand that is already there in latent form." Again, another prominent gas man, defining the word in its application to the gas business, has said: "Advertising is time or money expended to increase our business or interesting the public in the commodity which we have for sale, either by visual evidence, or by oral, written or printed arguments." If correct, the latter definition, you see, gives me a pretty wide latitude in handling this subject, and I have therefore taken the liberty of associating with it methods which are not ordinarily considered as "advertising," but which, nevertheless, should be conceded to be such since they have proved to result, directly or indirectly, in "increasing a company's business." It is a safe statement to make, I think, that advertising, in our business at least, is not particularly effective unless, or I might more fairly say it is vastly more effective when, it is followed up by intelligent personal solicitation. Many

people are often half convinced from reading advertisements that the thing advertised is desirable, but the feeling can only be ripened into real desire by personal arguments, which can seldom be set forth in written or printed form in a sufficiently attractive way to bring the "prospect" to the office. In fact, the soliciting force and the advertising work of a company are so closely allied that it is difficult to see where one leaves off and the other begins, despite the apparently broad line dividing the two departments. Advertising may be indirect or direct solicitation, while solicitation may be direct solicitation or simply advertising.

Often you hear the question asked and earnestly debated pro and con by gas men: "Are solicitors and advertising necessary to a Gas Company?" or "Are they a profitable investment for a Company?" I would answer these questions with another equally as sensible: "Is milk helpful to an infant?" And, of course, in speaking of advertising and soliciting methods, we mean intelligent methods, judiciously administered and energetically pushed; not the kind in use by men who believe "this was good enough for grandfather, so it ought to be good enough for me." Men in the "business getting" end of the work must be constantly on the alert for new ideas. You can have no sympathy, in this day and age of the business, for the gas man who is like the old farmer who said that "hearing both sides of a question always confused him." We must look into the other fellow's ways of doing things, and adopt them, too, if they are better than our own.

We are all familiar with the type of gas man who thinks his town is loaded with gas to the saturation point, and no doubt many here have been humiliated, though gratified, to learn that in spite of the fact that the town is already "saturated," astonishing increases in the sales of appliances and gas are made each year over the preceding one, So, if we wish eventually to make the showing that we should, we must, ourselves, firmly believe, and hammer the point into the mind of every employe of our respective Companies, that there is no such thing in the gas business as the "saturation point." By intelligently and perseveringly looking for them we can each year find more "prospects" for the sale of our product than ever before.

The man who handles the advertising and soliciting work of a Company, in order to be successful, must be broad-gauged. He must keep a constant and thoughtful eye open for new uses for his product, as well as for new and effective ways for its publicity. He must know where certain methods would bring good results, while others would fail. He must know something of salesmanship, something of the law of supply and demand,

a great deal of human nature and the best methods of appealing to it; must have a vivid and instinctive sense of the power of repeated impression; must know something of the force of striking display, and make use of all this knowledge as means to the end desired.

A Gas Company's stock-in-trade is "good will" and gas, and the successful sale of the latter depends on the quantity we have of the former. Corporations the country over are coming to realize more and more every day that, coupled with investment, energy and brains, there must be the "good will" of the public—that so vitally important factor in all branches of competitive business. The "good will" factor in the gas business is right here enlarged upon and made to appear the most important feature of the subject of Advertising, because it unquestionably has fully as great an influence over the growth and success of the Gas business as it has over the grocery business, the dry goods business, or other enterprises of a commercial nature, whose growth must depend on the patronage of the people of the community in which they are located. We all regret the tendency of the public at large during recent years to declare war against all corporations, and many of us shake our heads, and with an injured look on our faces, say that we of the gas business, innocent corporations, must suffer with the guilty, i. e., those corporations of greedy, grasping, "public-be-damned" natures, who are directly responsible for this feeling on the part of the public.

But let us look the question squarely in the face and inquire whether we have the *right* to assume this injured air. *Have* we done all in our power to prevent the seed of discontent from gaining a foothold in the soil of our local community? Let us be frank and admit that possibly without realizing it we have all more or less taken advantage of the somewhat monopolistic position we hold in our several communities to ignore the "good will" factor. I think many gas men are living in the last century in this respect and have not yet come to realize that we are not now living in the halcyon days of ten or more years ago, when Gas Companies in general were looked upon by the public with something of respect, or at least considered worthy institutions and, to some extent, public benefactors. This was when there was little or no talk of "trusts" and municipal ownership of public utilities. The weather vane of public sentiment has unfortunately of late years been veering to another and less favorable quarter, and the feeling against all private corporations seems to be growing stronger daily. The desire for municipal owership of public utilities seems to be in the air. The people at large appear to be going insane over the idea of operating, on public account, Gas, Electric, Water and Street Railway properties,

even though the privilege be a rather costly one. To illustrate this attitude of the public, I would quote a statement recently made by an alderman in a certain city in this state with reference to the local Gas Company: "I would do anything that I possibly could to injure that blank Gas Company!" When asked what his grievance was and if the Company did not give good service, he replied that he had no complaint to make of the quality of the gas or the service rendered. In fact, he had no doubt that they furnished the best of service—he was simply "dead against" all corporations on general principles and frankly said so. Of course, it is pretty hard to become friendly with a man so unreasonable as this, but inattention to his wants and indifferent service to the community in which he resides certainly would not tend to better conditions. We must admit that the time has passed, if it ever existed, when public service corporations can be in the least indifferent to consumers' complaints, whether these complaints be real or imaginary. Possibly *we* are somewhat to blame for this revulsion of feeling on the part of the public. Have we not all heretofore spent too small a portion of our time and energy in the cultivation of the good will of the business, which, as has been said before, in any ordinary mercantile business is so important a factor in its success? Have we been at all inclined to let the good will feature take care of itself? If so, let me ask, how long would a groceryman last in a community if he did not give the best of service and have courteous and painstaking employes? Are we as particular as we ought to be in the selection of employes for those positions which bring them in contact with the public? Do the officers of our several companies give this detail of the business enough personal attention, or do they carelessly remain ignorant of the fact that some misfit employe is every day multiplying enemies for their company by his "grouchy" manners or lack of tact, whether intentional or unintentional, in dealing with customers? Do we take the pains to properly inform each and every one of our employes who comes in contact with the public, whether he be an Application Clerk, Salesman, Collector, Cashier or Shop Man, how vitally important it is that he be courtesy personified? Do we, by individual instruction and daily, weekly, monthly, or even yearly department meetings or mass meetings of all our employes, sufficiently drill our trouble men, fitters, meter readers, salesmen, collectors and other employes, in such things? Do they thoroughly understand that a job is not half done, even though it be a workmanlike job, if the workman's manner toward the customer has been such as to leave a single trace of dissatisfaction in the mind of that customer?

It is my opinion that the best advertising a Gas Company

can have in the present period of the business is a satisfied consumer, a real friendly consumer—one who, when he hears the words "Gas Company," thinks of an association of fair-minded business men, human beings like other merchants, who respect the rights of the public. We certainly do not want to be thought of in the way that "trusts" and large corporations are caricatured in the daily papers during a political campaign. Unquestionably the tactless and "grouchy" manner or the "you may take it or leave it" air exhibited by many ordinary office clerks has indirectly cost many corporations thousands of dollars through loss of business and incalculable harm through unfavorable public sentiment. It is undoubtedly also true that the Gas Company which has the good will of the public is the Company that sells the most gas per capita and makes steady and satisfactory increases in its earnings from year to year. A satisfied consumer may be the lever by which a dozen others may be gained. It is an endless chain scheme.

The Grand Rapids Company has gained a reputation for selling considerable gas per capita, and if one should analyze the situation they would find that it is not because they are any more clever or have any more or better opportunities to dispose of their product, but their comparative success is largely due to the fact that a great deal of their energy for many years past has been spent in properly caring for the wants of consumers and in investigating and adjusting every complaint as soon as it showed its head. The following editorial from a recent number of the "Michigan Tradesman" will give some idea of how valuable to the Company this "good will" of the public is from an advertising standpoint:

> "When a customer of the Grand Rapids Gas Light Co. registers a complaint he is called upon instantly by two pleasant faced young men, who proceed to investigate the complaint and adjust the matter to the satisfaction of the customer. When a customer of the Grand Rapids Edison Co. makes a complaint he receives a peremptory letter to call at the office and be convinced that he is wrong. The difference in the two systems is quite manifest —one corporation undertakes to cultivate the good will of the people, while the other proceeds on the 'public-be-damned' plan."

Anyone who is acquainted with the Editor and owner of this paper knows that comment such as that could not be secured editorially for any amount of money unless he thoroughly believed the Gas Company deserving of the compliment. It is, to

my mind, the best kind of advertising and counts more with the public than a hundred paid advertisements.

There ought to be no such thing in the gas business as a "Complaint Department," and if there is now such a sign in a Company's office it ought to be taken down at once and metaphorically hung over the door leading to the office of the management. The word "complaint" implies a grievance against the company's service or employes, and whether such grievances are real or imaginary they should come, and be gladly welcomed, to some officer of the company competent and with authority to promptly and properly dispose of the matter in a manner that will leave in the mind of the consumer a feeling of friendliness and respect for the company. I say complaints, whether real or imaginary, should be *gladly* received by the management because if the feeling exists no one on earth has more cause to regret its existence, or more to lose if it remains, than the company itself. Therefore, the quicker they learn of it and adjust it, the better it will be for them. Do not, by a displeased look when you listen to their troubles, encourage the consumers to "tell them to the policeman," or still worse, to their neighbors. Let the customer feel, by your cheerfulness of manner, that complaints are so scarce in the gas business that his is a decided novelty. That will be the best and least expensive advertising you can do. When a gas man, even though his desk be crowded with work, cannot listen patiently to a consumer's grievances, no matter how trivial or disagreeable, and furnish a means of adjusting the trouble—when he cannot do this as courteously and, outwardly at least, as gladly as though it were a matter of personal interest to him, he needs a vacation, and someone ought to insist upon his taking it, for he is certainly a detriment to his company while he is in that frame of mind.

Most so-called complaints that reach a gas company's office are merely consumers' troubles, for which the company is in no way to blame and the occurrence of which is often beyond their control. So let us not unnecessarily assume the responsibility for these disagreeable incidents to the business by designating, and thus acknowledging them, to be "complaints" against our service. Get away from the word as much as possible. Don't have a "Complaint Department," or a "Complaint Window," or at least don't call it by that name, because it cannot but have an undesirable effect on consumers.

The experience of many gas companies has been that gas arc lamps and Welsbach lights, sold for use in the business section of any city, must be carefully inspected, cleaned and kept in order by a special department, known as a "Maintenance Department." Periodical inspections are made by competent men

and often enough to insure the highest efficiency for the quantity of gas used. Usually a flat monthly rate per lamp is made the consumer for this service, and the charge ought to be low enough to get all lamps in the business section on the maintenance list. I know of no better advertising for a Gas Company—advertising that will have more weight with a prospective customer who may be wavering between the use of gas and some other form of lighting—than to be able to show him a line of stores brilliantly illuminated with well-kept lights, having clean glassware and well-filled mantles. The consumers themselves will not keep their lights properly cleaned and repaired, and is is better for the Company to furnish the service, even at a slight loss, than to allow the consumer to attempt it.

Poor service sooner or later means competition, possibly municipal ownership; and it has been demonstrated beyond a fraction of a doubt that a well-conducted "New Business Department" or "Commercial Department," through proper efforts to look after the wants of consumers, is the most effective insurance against competition. Besides being self-sustaining, it furnishes a means of increasing a company's revenue to a surprising degree. In Grand Rapids, where there are approximately an hundred thousand inhabitants and the Company's mains very nearly cover the entire city, we have found that satisfactory increases in gas sales are made by dividing the city into eight districts and putting a competent man in charge of each district, who understands that he is responsible, and is also given credit for the conditions in that district so far as the company may be effected, and that all grievances of consumers are to be carefully adjusted or are to be reported to the office, if he cannot properly adjust them. Because of the broad nature of their work, and also because the term is a more dignified one and leaves a better impression with consumers, we call the men in the Commercial Department "representatives" rather than "solicitors." Each representative has a residence as well as a business portion of the city to look after and, in addition to the eight regular men, there are two saleswomen in the office and two special representatives, one of whom works up and closes business to be had on new main extensions, and the other being an expert "trouble man," who stands ready to take care of any important "rush" matters that the manager of the department may refer to him, as well as to aid the regular representatives in closing difficult deals requiring help. All representatives are required to take a preliminary course in the practical shopmen's line of work so that they may be familiar with the practical workings and adjustment of every burner, appliance and condition that may arise in their territories. Representatives are kept busy in the Spring, Summer and Fall

in securing additional business through the sale of gas-burning appliances, and in Winter a major portion of their work, aside from pushing the gas arc lamp business, is to ascertain, by house-to-house canvassing, the gas conditions in consumers' and non-consumers' premises, personally adjusting or securing the adjustment of any burners that may be out of order, or in fact adjusting any annoying conditions that may be found, incidentally keeping an eye open for possible additional business. A representative must largely make his own prospects, and let it be borne in mind that there is a great difference between the man who must go out and secure business from the man who thinks he has no need for the commodity which the company has for sale and the employe who stands behind the counter to do business with the customer who must and seeks to do business with the Company. The Commercial Department ought to automatically keep the management informed as to conditions throughout the city as to the sentiment of the public. If any of the several employes—clerks, trouble men, collectors, etc.—who come in contact with the public, treat it in an arbitrary or improper manner there will be complaints from the representatives that their efforts are being handicapped by the improper conduct of other employes, because the representative soon finds that he cannot do business with the people in his district if consumers do not feel friendly toward the company.

Following a plan in use by the Denver Gas & Electric Company, we have for some time been holding half-hour morning meetings of all members of the Commercial Department, presided over by the Department Manager. Instructions are given, experiences are exchanged, friendly rivalry for best results is encouraged. The President and General Manager, Secretary, and other officials of the Company attend, and perfect harmony prevails. A stenographer prepares typewritten minutes of the important points brought out, which are bound in book form, indexed and kept for ready future reference. The meetings are not only inspiring and helpful to the employes, but are exceedingly beneficial to the Company.

Many will wonder what this all has to do with a paper on "Advertising," but we have found it to be the very best form of advertising, as it has secured to the Company an unlimited number of friends among that class of fair-minded people who are not slo wto say a good word for any company that considers it a calamity to have a single dissatisfied consumer on its books.

Now, referring to the methods known as written or printed advertising: Very often you hear the question asked, "What method of advertising is the most effective?" It is a hard question to answer, and depends considerably on local conditions and

how closely and in what manner the business has been developed in the past. Methods that might be adopted with profit in one city because new to it might prove a flat failure in another because old and worn out. In this connection, it might be well to note that a somewhat inferior method intelligently and energetically pushed will often produce much better results than an excellent method indifferently applied.

Regarding the question as to the best kind of advertising, I am reminded of the experience of the advertising agent for the "Farmers' Fireside Companion," who once had the temerity to approach Dr. Blank, the great pill manufacturer, himself somewhat of a dyspeptic, for a liberal advertising contract. The Docton glanced a moment through the sample copy, threw it to the floor, and said most emphatically: "That advertising would do me no good. Why, I wouldn't waste my time reading such a paper!" The agent smiled and said confidentially: "To be equally frank with you, Doctor, I wouldn't dare take one of your pills, but remember that 137,000 people *do* buy and read my paper and they are just the kind of people who will buy your pills." The Doctor saw the point and signed up for a half-page. The incident teaches two things: (1) that the prospective customer who hollers "No!" the loudest when first approached is often the most profitable and satisfactory one when you do land him, because he thereafter "sticketh closer than a brother" and cannot be easily coaxed off by your competitor; (2) it shows that none of us should be entirely guided in our choice of advertising methods or the purchase of goods for sale to the general public by our personal feelings, tastes, likes or dislikes. We must carefully analyze conditions and find out what people want, or we will not be able to interest more than a very small portion of our prospective purchasers. Nor will any one method land them all. An advertisement for a $9 house-piping proposition, to include all expenses for piping, labor, fixtures and glassware, would not be worded or handled in the same manner that would be effective for an expensive line of art-glass reading lamps. The people to be reached in the two cases are not in the same circumstances as regards wealth, and possibly education, and are not looking for the same proposition. The value of a certain method of advertising may depend on the nature of the thing to be advertised. For instance, one of the cheapest and most effective ways for promoting the sale of Coke is by means of short, readable advertising stickers, pasted on the face of gas bills. It is evident, however, that our energy would be wasted if we should attempt to secure entirely new gas consumers by such a method.

Street car advertising might be very effective in Detroit, because of the up-to-date service and good, well-patronized cars of

the Company, but might be useless in Podunk for the opposite reason. Generally speaking, newspapers furnish the best means of reaching the masses, but there are certain kinds of business, for instance the big industrial fuel prospects, which could not be reached as effectively and inexpensively through that medium as by some more direct method. The prospects for gas engines are comparatively limited in number. There may be in a certain city 100 prospects for them, and a personal letter is, in that case, the thing to use, followed up by the personal work of the representative. If there were 1,000 or more prospects they might best be reached by the newspapers.

How much better it would be for us if we could devise schemes for inducing present consumers to use more gas, or gas for many different purposes. Such increased sales require no further investment on our part in mains, services, meters and connections. An important thing is to popularize the gas range for Winter use. Educate the people to realize that there is no "season" for gas ranges, but that:

"In winter they are just as fine
As in the good old summer time."

A consumer who uses his gas range in winter as well as in summer is a better one for us than two consumers who only use their ranges in the summer, because the Company's investment is smaller in the first case, while the consumption is as great as the latter two combined. Do some missionary work among the architects and furnace men and see that all new houses during the process of construction are provided with a hot-air pipe, steam or hot-water radiator from the basement furnace to the kitchen, so that the kitchen will not have to depend on the wood or coal cook stove to warm it in the winter. Have the representatives watch carefully all ne wbuildings to see that gas-pipes to gas grates, gas ranges, fixtures, circulating water-heaters, porch lights, basement lights, etc., are on the architects' plans, and further see that all piping is of the proper size. The owner will always appreciate suggestions of this nature if properly presented to him.

The people we try to reach by our advertising methods are all busily engaged in their own affairs, and it often takes a long time for the point to hit the mark. Money, therefore, spent on solicitors or in advertising may not bring returns for a long time, but if you keep after it intelligently and long enough you will surely bring the money back with liberal interest.

The character of the argument, the quality of the matter, the method of displaying it, all have to be considered by the advertising man because he has many classes of customers to appeal to, and no one argument or method will catch them all. He has

the busy man who will not read the long argument, the person who is prejudiced or misinformed, the one who is entirely ignorant of the problem, and also those who need only a reminder to avail themselves of the proposition offered. Many prospects require an extreme degree of persistence and cleverness, or both, while to some a simple notice of where certain things can be purchased at a certain price is enough to bring them, as they probably desired the goods but did not know where to get them. Many prospects require considerable argument before they will buy, but arguments in an advertisement are of no avail unless they are read, and the advertising man must study to display the matter in a manner that will insure its being read, at the same time being careful that the effort put forth to make it catchy does not spoil the effectiveness of the argument. Cuts may be made very helpful in displaying an advertisement by drawing the attention to the subject matter, but care should be taken that they are appropriate, that is, have some relation to the subject and are not simply put in to fill up the space. It's a pity, too, to have your attention drawn to an advertisement by the force of an attractive cut, only to find coupled with it uninteresting and useless printed matter. Such adds remind one of the man who asked: "Don't you think my beard improves my looks?" "Yes, I do," answered a friend, "because it covers up most of your face!"

Because of the fact that most newspaper advertisers crowd into a given space all the matter possible, thus making a black looking page, I believe that a very effective method, when very good cuts are not available (and good cuts cost considerable money), is to use liberal white space around the printed matter or the subject of the advertisement, also being careful not to use over two or three sizes of type. Such adds will instantly attract attention on any newspaper page. A few sample advertisements of this character are given herewith, and you can easily demonstrate their effectiveness by inserting them in your local paper, set up as they are given here.

Street car advertising acts on passengers in a more or less compulsory way. It cannot be escaped, especially when one is a constant daily patron of the road. It is, therefore, a valuable auxiliary to any other form of advertising. A story, however, which requires more or less detail in telling it, cannot be successfully handled in street cars. Such matter can only be exploited satisfactorily in newspapers, pamphlets and mail advertising. That street car advertising is very effective is shown by the fact that the bare advertising privilege covering a period of five years in the New York Subway trains, using approximately 2,000 cars, was a short time ago awarded to Ward & Gow for $1,000,000. Each car contains 42 cards on the sides, with end

space in addition, and the average charge to advertisers is about 60 cents per month. Ward & Gow also control the advertising privilege on the Manhattan elevated lines, as well as the elevated station news stands, so that from past experience they know that no great difficuty will be encountered in sub-letting the space to advertisers equally alive to the fact that each year over 1,350,000,000 fares are handled by the New York City railway lines.

I realize that too much of your time has been taken up with this paper, and I will close by quoting a sentence I recently read, which contains words of encouragement to the progressive gas man:

"The man who studies mankind and ascertains what men really want, and then supplies them with this, whether it be an Idea or a Thing, is the man who is crowned with honor and clothed with riches."

Sample Display Advertisements.

Keep Your Wife at Home these Hot Days!

Because if she should happen in at the Gas Company's office she could not resist buying one of our cool, comfortable Gas Ranges. You know they are sold on monthly payments of $2.00 and connected free.

GAS COMPANY, Cor. Ottawa and Pearl Sts.

OUTSIDE LIGHTING.

A *successful outdoor* Gas Arc has made possibilities for considerable outdoor and *window lighting* which has heretofore been left almost *entirely* with the *electric* people. In the past most gas companies who installed outside lamps in front of a place of business placed the lamp in the entryway, no provision being made to protect the gas from freezing. In some cases a connection was made from a drop inside the building and a three-eighth pipe run to the outside where the lamp was hung. Sometimes a drip was placed on the three-eighth run, but, in most cases even this was not done, and in severe winter weather the lamp would be out of commission to the disgust of both the customer and the gas company. With the above installation you lighted only the entryway and not the windows, and the customer was obliged to light his windows with either gas or electricity the same as before. Where an outside gas arc lamp is used to light windows it gives a better opportunity to secure the lighting of the store on the inside. Ofttimes the rate is such that if the customer is obliged to light his windows with electricity it is difficult to secure his inside lighting.

Within the last year a great many gas companies have been experimenting and have demonstrated beyond the possibility of a doubt that the average window, if not to deep, can be *better* lighted for *less* money with outside gas arcs than by any other means. By this I mean that the initial cost of the gas equipment will not be any gretaer than the initial cost of the electric wiring, sockets, etc., and the cost of operating the lamps on the same number of burning hours will show a saving of from 40% to 60%. On a window 20 ft. wide three outside gas arcs will throw more of a better light in the window than 50-16 c. p. incandescents, besides throwing a brilliant light on the front of the store, lighting the sidewalk to the curb and making a *light attraction* that is noticeable up and down the street for a considerable distance.

Considered from the advertiser's standpoint, both for the consumer and the gas company, a row of outside gas arcs which illuminate the windows and the entire front brilliantly is the cheapest good advertising that I know of. It distinguishes his store from the other fellow's, because he not only has more light

in his window than the other fellow, but has the additional light on the outside, and for less money.

An outside gas arc, if properly maintained and adjusted, will burn from dusk until ten-thirty, which is an average of four hours per night for the entire year (365 days), or, a consumption of 2,000 ft. of gas per month (which is equal to that of the average gas range), and is *mighty* good business, as the gas company gets the benefit of some of the advertising.

In this city we have what we call a *turn on and off* service which we give the outside arc customer without charge, and at a slight expense to us we have the assurance that the lamps are "working while we sleep" and that the average consumption per lamp per year will be 24,000 ft. of gas.

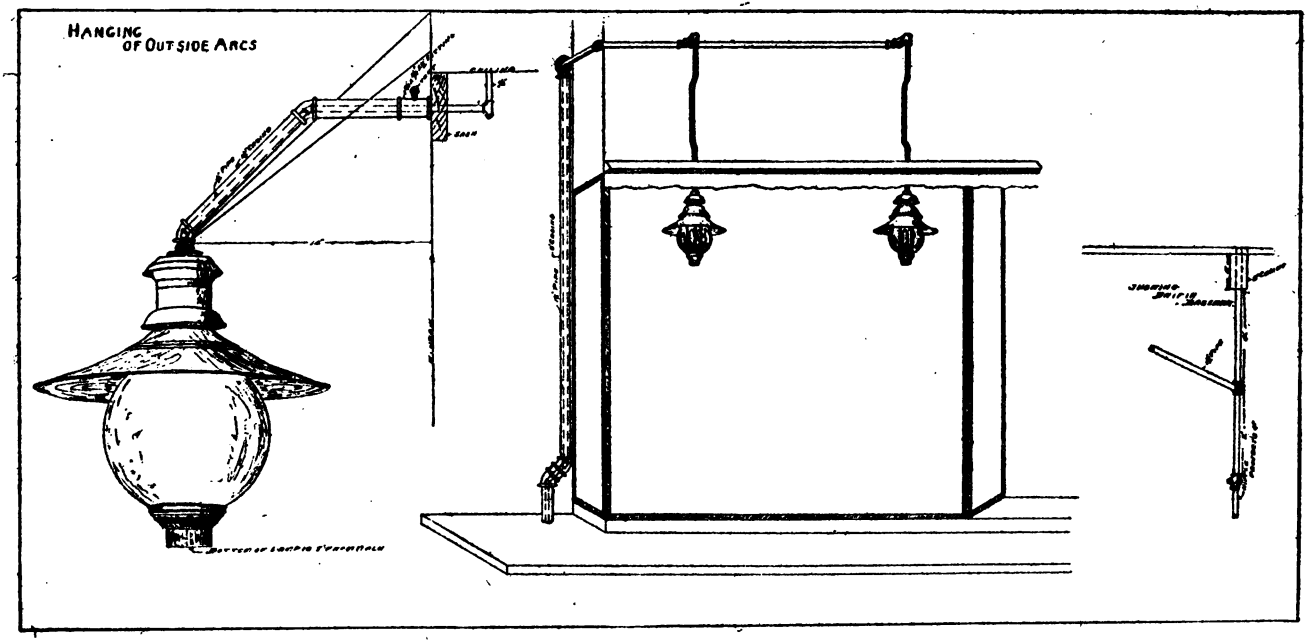
The effectiveness of the idea increases in proportion to the number of lamps that are hung in succession, for instance: two arcs hung in front of a man's store more than double the effectiveness of one, and ten or twenty-five in proportion. The Detroit City Gas Company has recently made a unique installation of outside lighting which, I believe, is the first in the country. They have extended a line of pipe along the entire block in which the gas office is situated (John R. to Wilcox Street) and have installed 29 outside gas arcs, which displace all the window lighting which has heretofore been done from the inside. This installation not only lights the windows better than they were lighted heretofore, but lights the sidewalk and front of the block so well that if you should shut your eyes and forget where you were when you opened them you would think you were on "Bright Broadway."

INSTALLATION.

Where only one or two outside lamps are to be installed in front of store or business place and three-eighth drop is found inside window with good supply, one-half inch pipe is attached to this, carried out through window and extended down to lamp with two forty-five degree ells.

For this installation four three-sixteenth inch holes are drilled in top of lamp and a two by one and one-fourth reducing coupling is placed so as to come on outside of openings in top of lamp. From this reducer, one and one-fourth inch pipe, termed casing, is extended back within one inch of window sash, where a reducing tee is used with one-half branch looking up from which a return bend or (plain ell and street ell) is used to conduct heat from inside casing, and thus exclude water from rain storms, etc. The end of this reducing tee fits closely around one-half inch run.

For three or more lamps a riser is run on outside of building,



in the least conspicuous place, a larger pipe or casing placed over riser which opens into basement or cellar, thus conducting warm air from basement up to top of riser.

A tee is placed "bull headed" on top of casing to exclude water from rain, etc. Where riser is cased in this manner it is not necessary to case run or drops. Drop is taken from side branch of tee, and where possible all drip water carried back to riser where a large drip is placed in cellar.

As it is sometimes impossible to carry all drip back to riser an additional drip or extra riser is placed between store front, or the next location, and carried back into basement. This is also cased in the same as riser with a stop cock placed in bottom to let out drip water. On outside run, between Wilcox and John R. there will be three main risers and two drip risers when job is finished.

To avoid the annoyance of boys turning on and off the lamps it was deemed advisable to change the style of the key to the square block. In this way it is easily turned on with a long key, and it is not easy for the mischievous boys to annoy the consumer.

GAS FOR ADVERTISING.

By Bert Mason.

Use lights for advertising because that is the best manner by which you can advertise. Now what does this mean? It means just this. You can get more for your money advertising with lights than any other kind of advertising. Your lights will give you the quickest results, and you can prove the results attained from lighting to your entire satisfaction at once. The writer does not wish to condemn newspaper advertising, but insomuch as the writer has made the statement that light is the cheapest and best, it is his duty to show you that his statement is correct. In this up-to-date age, less than thirty inches per day of newspaper advertising is of little or no value; all business men of sound judgment concede this to be a fact. Why? simply because the large merchant uses so much space that the smaller add is hardly noticed, if, indeed, at all. Has it ever occurred to you when you take up your paper to read your add, how long it takes you to find what you are looking for? Now if you cannot find what you are looking for, how can you expect the public to find what they are looking for? For half the amount of what thirty inches of newspaper advertising would cost you you can buy gas enough to light your store so attractively that everybody could see your wares without having to search the newspapers for them. Perhaps you will say, "this is all very well if I were on the main street." Not so. The reason you are not on the main street is just the strongest reason why you should advertise with light. Again why? Because the main street in most cities and towns is generally well lighted. This is also the reason why they become the main street or streets. If you are located on a side street, light up your place, crowd in all the lights you can and your place will be a blaze of sunshine in the midst of darkness. Your store will be distinctive in itself, because light is an attraction to all people. It is the greatest contrast to darkness, it is a thing of beauty, and beauty is an attraction to the rich and poor, educated and uneducated; in fact all. Yes, everybody is attracted by light. However, the man who lights up his store first on the side street will not be long

alone. The other merchants near him will notice his success and very soon he will see his near neighbor trying to outdo him by lighting up better than he has. Now two or three places on your street will light up to outdo both you and your neighbor, and in the very near future you will find you have a well lighted, attractive and beautiful store that will attract much new business. What does this mean? It means that if you are wise when you start in to light your store you will secure a long lease at your present rate. This is what you have accomplished. By lighting up your store you started others to do the same, soon all the street became well lighted, and thus you have been the means of creating another main street. Of course you have saved the expense of moving on the main street at a greatly advanced rate of rent, you have leased your present store at a very low rent for a number of years, and last of all, you have brought the main street to you instead of moving to the main street. There is every reason to believe that the new main street will do more business than the old main street because of its newness. Now then, when the street is well lighted your chances of doing business have not decreased, the street has became so attractive that there are many thousands of people passing now, consequently the increased number of passersby on your street have increased the number of those who enter your store, and, of course, you have increased the number of sales and also your profits.

I have said that lights will give you the quickest results; to prove this statement all you have to do is to stand outside of a well-lighted store for half an hour, then devote half an hour at a dark store. You can see the results in thirty minutes. Furthermore I said, you can prove the results. All you have to do in this case is to go to some nearby town or city, ask the owner of a store that is well lighted if it pays him to light up, and his answer will be your proof. The reason you will have to go to some other city or town for information is, because the well lighted man i nyour own place is fearful of somebody else learning his secret of success. The vice of defect is far worse to the business man than the vice of exess. There is a tendency when a businessman starts in to advertise to commit the vice of defect. He does this in the following manner: instead of trying to see hom much money he can spend in the best possible manner, he will try to spend as little as possible, and nine times out of ten all he spends is a total loss. One man will open up a store with a handful of goods and one light, then say, "Well, I don't care to spend an ymore money until business will warrant it." The man's business will never warrant the investment of any more money, because he is defective and not capable to manage any business. To advertise with light is not an idle fancy or a mere

dream, it is following up what the large cities have done, and are doing. Take any of the large cities. Do you suppose they light up their stores and keep them well lighted all night just to spend money? That is not reasonable, it is done to make money. Having proven to you that light is the cheapest and best kind of advertising let us consider for a moment how to use it, and use it right. The old way to light a store is to commence in the rear and light to the front as fast as daytime leaves the store. This way is wrong. The right way to light a store is to begin outside, then light the windows, next the inside of the store, and last the rear of the store. The outside lights attract people to your store, the window lights attract them in, the inside lights show off your wares to the best possible advantage, and now you have a system of advertising with lights that is complete, cheap, attractive, and the best on the market today. The man who hesitates is lost. After all, he mey be found, but the business man who hesitates to acknowledge the benefits of advertising with light is worse than lost, he is dead, and will never come to light. You probably have seen or know of one or several stores that have been opened by men who have entirely failed to do anything and given up in despair. Again, a man has come along and opened the same kind of a store where those other people have failed, and yet this man has made a great success. Look this man up and you will find that the man who succeeded tried to see how much money he could spend to make his place attractive and beautiful by lights.

At this part of my paper let us consider newspaper advertising, circular advertising, and in fact almost every kind of advertising and its connection and relationship to advertising with lights.

For instance, if a man is a large newspaper advertiser or circular advertiser; we will take, for example, that he is advertising Kilmer's Swamp Root thoroughly and extensively. What does he accomplish with all of this advertising? A great deal that is true, but such advertising stops at just the vital point where light advertising steps in and closes up that business. Supposing a merchant spends hundreds of dollars advertising his special line of goods, he simply acquaints the public with the name of the article and the nature of the article, and in many cases induces the public to think that that special article is a wonder, but does the merchant put the article on the market at this time? I say no. The retailer does that regardless of all the other expensive advertising done by the wholesaler or even the retailers, the article goes on the market and is sold to the public from the best lighted stores. Just consider for a moment sitting in your house reading a newspaper, you glance at the

advertisement of some particular article advertising some special article that you are about to purchase; they advertise this article very cheap, much cheaper than you could purchase the same article at another place, you put on you r hat and start to go to this store that has so advertised. When you get on the street you arrive at a beautifully illuminated store, you see the same article that was advertised by the other merchant in the window of this beautifully lighted store at an advanced price of what the other merchant advertised to sell the same article for. What is the consequence? Just this. You enter that beautifully and attractively lighted store in the first place because the light has attracted you; in the second place, because the light in your opinion has made the article that you were about to purchase look brighter, fresher ,and in fact more valuable to you than the same article would look in a poorly lighted store at a discount figure.

This example brings out the point, that although the man may advertise in the newspapers and with circulars and many other ways, he is simply assisting the man that lights up his store thoroughly, beautifully, and I may say, properly.

In conclusion the writer begs to say that in his opinion he is not in the smallest degree trespassing on any or all other kinds of advertising, but insists that without a thorough system of advertising with lights be attached to all of his other advertising he is incomplete and will not be successful because his method of advertising is insufficient.

DISCUSSION.

Chairman—I do not think it is any detraction from any other paper to say that this is, probably, in one sense, the most important subject that has been brought before our Association; in this sense, that you may make your gas by the most approved method, and have it of the highest quality, but if you do not get out and sell it it is not much good to you. At the same time the man who is making gas in the works is advertising the company's business, because if he does not make good gas it will be heard from in the office, and will distinctly hurt the business. I do not believe that there is a man in any capacity in the employ of a gas company who is not distinctly responsible for its advertising, and he advertises it for good or bad. We are to be congratulated that Mr. Chamberlain treated the subject in such a broad light. He makes apologies for taking up our time. I think a good deal more of our time could have been taken up in the same intelli-

gent manner. I do not think in this discussion that I shall call on anybody to discuss it. I think everybody in the room should have some ideas, and be willing to express them, as helpful to the business. I think we ought to go right down the line. Mr. Knight.

Mr. Ewing—On the first paper, I really would like some consensus of opinion, because the Detroit City Gas Co. has been criticized by a good gas man for the method that they have adopted for hanging outside arcs. I think a good many of the gas men in Michigan think that we are going to have enough trouble this coming winter to get any profit, or possibly more than the gross receipts or cost, in taking care of those lamps. I really would like to have an opinion as to why that kind of piping won't stand any kind of weather.

Mr. Mason's paper I think is an example of enthusiasm but I don't think that he has studied the advertising question from anything but an enthusiastic standpoint. He has made statements there that I cannot very well agree with him at all. I do some advertising for the Detroit City Gas Co., and I don't know how we would sell our lamps unless we had some other means of advertising them, other than putting them up. You have to advertise them some way to get them up, and I believe there are lots of good ways to advertise, other than light, not but what light is a mighty good way to advertise, because I think I have shown in Detroit that I believe in light for advertising.

In Mr. Chamberlain's paper, I think he has covered it in a very broad sense, and it appeals to me in this way, that he is simply demonstrating to the advertising man, that it is absolutely necessary to start right in the office. You cannot expect to spend a volume of money in any kind of advertising and obtain results, unless you have got the goods to deliver. I think Mr. Butterworth will agree with me, when he started a campaign a few years ago on the coke question, that it didn't make any difference how much money we spent in advertising, if we did not deliver the kind of goods we were talking about; and we had a lot of trouble. So, I think the first essential in advertising is to start with the office and be able to deliver to the public exactly what you are talking about. If you tell a man he can get the best results for the least money, I think you have to do it.

Mr. Chamberlain speaks about advertising, and says that he believes that the advertisements should have plenty of white space about them. I believe just the opposite. I would rather have an inch of black around it than an inch of white; and I think I will have a great deal more trouble in buying black than I will white. The papers in the City of Detroit won't give you a border of more than ⅛ inch unless it is in cut form. I just give

you that to show why I would rather have black than white. You can buy all the black space yo uwant.

Street car advertising, I believe, is good advertising. I think a little of it is a mighty good thing, and so far as forcing advertising upon the public, I do not think it is any more forcing upon the public than an advertisement in the daily newspapers. Today, the woman who is going to shop, scans the paper to find out what she will buy, she intentionally reads the advertisements. A man who is sitting in the street car, intentionally reads the cards to find out what people are doing, and what they have to sell. I have heard more from adverse criticism of street car advertising, but I think a little of it is a good thing.

Chairman—I minght say in regard to prospective trouble, that I was in Minneapolis last winter, and while the outside arc itself had not developed to such an extent, arcs in cold places were taken care of all right by using dehydrators, each one of the boxes being filled with dry lime, and for ordinary climates, Mr. Shepherd, the superintendent there was of the opinion that a large pipe would accomplish all that was necessary, and the frost and naphthalene would crystalize on the pipe, still leaving sufficient passage for the gas, and would not be stopped up before the naphthalene would be dissolved and carried on through the burner.

(Member)—That is frost?

Chairman—Yes. I think it is more likely front than anything else.

Mr. Freese—I do not think I can add anything more. My experience has been that if you enlarge the pipe at the point where the warm and cold air meet to four or five times the size of the regular pipe, you will have no trouble. I had some experience with outdoor lights at Laporte, Ind., that we put up on brackets, and I ran the pipe down the inside of the building and attached to an inch and a half pipe. That formed a bracket for the lamp, and they never gave a bit of trouble after that, but before that we had trouble every night on account of frost. Otherwise I should say it was a very good paper.

Mr. Blower—I have not any suggestions to make to this paper on advertising. I do not feel competent to add anything to that. However, speaking of outside lamps, in the winter of 1903 we had a number of old fashioned Humphrey lamps in Kalamazoo. They were attached to ordinary lamp posts by gooseneck ¾-inch pipe without any further protection, and they stood out there all winter. Sometimes we let them burn a few hours in the evening, and other times we let them burn all night, in all kinds of weather, and tried it and we had mighty little trouble in their freezing up. I don't think in the winter time more than

four of them froze. It seems to me with an enlarged pipe with the improved method of installing these outside lights there should not be very much trouble in keeping them going all the winter. I rather think it is a mistake to light up a whole block, covering several stores with a continuous service pipe, or continuous pipe light without reinforcing it from each store. It seems to me there is more chance of trouble in your riser if you put all your stores out of business; whereas with a separate riser to each store, it is hardly posible that they would all freeze up at once, and you would only have an isolated case to attend to, and it would not be so noticeable.

(Member)—I would like to ask Mr. Butterworth if it is necessary to send two men to answer a complaint. I see here he sends two men to answer a complaint.

Mr. Butterworth—Of course we are not responsible for Mr. Stowe's statement in the Michigan Tradesman; but we do in case of a complaint of a serious nature—a difficult matter, send two men. Ordinarily in an urgent complaint, we send two men.

Chairman—How about the Adrian Gas Company?

Mr. Wirt—Our plan in outside arc lighting is a little bit different from Detroit. There is a casing up to where the hull-head tee is. Ours just goes through the base of the window. We have an inch and a quarter riser in the larger plant. We had practically all of the inside light while the windows had electricity. We had to get around that some way, and of course the outside light was the only thing that appealed to us, and we made headway with that.

I like this paper here of Mr. Chamberlain's in satisfying complaints. I think we are all a little short on that. A woman will come in with something that to us is nothing, but to her is a great deal, and if fixed up satisfactorily to her, she will go and tell her neighbor—"Well, I knew there was something wrong, and they just fixed it up for me all right." I think that is one of the best means of advertising you can get.

I would like to hear some opinion as to lighting both sides of a street in a small town. The thought occurred to me that you had better line up one side and keep them going, we will say, until 9 or 9:30; while if you undertake to light both sides, the man across the street will see how the other fellow's light shows on his side, and he has a tendency to cut his light out. I noticed in our town, one man who had a light, as soon as we got it on a line of 17 on one side, he cut his right out entirely. I told him he ought to go over and divide with the other man on the expense. It didn't cost anything to light him; and it is an absolute fact they came and rubbered in his window just as much as they did in the window of the man who had the light.

I think it would have been fair for him to light it up a little. In thinking it over, it occurred to me, that instead of pushing the thing to a complete standstill and having everybody have them at a great deal more expense, to have a line on one side of the street doing business every minute rather than to increase the expense and have them crippled. You take it in a town under 30,000, people have an idea that 9 o'clock is roosting time, and all go home, and we have to fight that proposition pretty hard, to get it in their heads that after 9:30 their windows can still be doing business, because if it is worth 10c an hour in the day time, it should be worth 30c at night to have their windows displayed. I think we have that pretty well established, and we have not had a great deal of trouble; but I don't know what any of the rest of you think about putting lights on both sides of the street. I would like to hear about that.

Chairman—I think that ought to be qualified by the explanation that Mr. Wirt is operating under a leasing system, in which the company owns the arcs. In Detroit, they sell them outright, the consumer owns them, the company only maintains. Those two systems probably have some modification.

Mr Traver—About the only way is to make good gas, that is the only thing that is possible. Our works men are as much in sympathy with this movement in Grand Rapids as the people in the commercial department, that is, each one of the works men, except labor, are just as much in sympathy as the other people, and do as much work outside. They attend to the complaint work among their neighbors. We have got that spirit through the whole place, and it is really doing a great lot of good. That is about the only way I can see we can do.

Chairman—Do the works men have a representative on this commercial board, so to speak, or meetings every morning?

Mr. Traver—Oh no.

Mr. Butterworth—But each one meets with the department himself.

Chairman—Outside of this the men in the works do not attend this commercial meeting?

Mr. Traver—Oh no, but the commercial men visit the work quite often, and most of the people are pretty well acquainted with each other, and they understand what this commercial department is for.

Chairman—In other words, you make the commercial men recognize gas when he sees it at the works.

Mr. Traver—Yes. The reason for that is to have those commercial men familiar with all departments and to find out how the gas is made, so that if anything comes up, they can tell what is the matter, if the customer wants to know how coke is

made they are perfectly capable of telling it to them. As the departments change, new men come in and others go out. They go down quite often and go over things so as not to get rusty on them.

Mr. Shacklette—Mr. Chamberlain says, do not have a complaint department, and do not have a complaint window. I would say, do not have a complaint form either. We have none, and we do not allow a clerk to use the word complaint in our office. We call it a trouble order, that is the word used by telephone companies, they are mostly trouble orders.

Another thing, in connection with our outside arc light, which may bear some ridicule, we are turning our advertising space over partially to the people who are doing this outside lighting. For instance at the head of our advertising: "Our designs cover all requirements of artificial illumination. Colors will not run together when lighted by the gas arc. See the magnificent display of statuary at Beck & Egan's furniture and crockery store, any evening. Gas Company." When you see anything in a gas lighted window you know it will look just the same in the day time. Our principal object in this is, not to get more outside gas advertising, but to induce the man who sees that light down town, to go and pipe his house for gas, and we are getting a great deal of business in that way. There is 10% of our customers that come in there and say, I want my house piped for gas, I saw it in such and such store, or such and such shop, and it is the best light I ever saw, can you fix my home up the same way; and we have piped three or four times as many houses this year as we did last.

Mr. Cantrell—Mr. President and gentlemen, I beg to say in connection with Mr. Murray's paper, I think he should be complimented on preparing a paper at such short notice. Certainly there are some very instructive ideas in connection with it. I might say in Grand Rapids, we are pushing the outside arc business very vigorously. We have about 176 outside arcs installed, 76 of which approximately are used only during the summer months, but the other 100 are used every night in the year. Probably within the last six weeks we have installed 88 outside arcs on the same lines as the Detroit Company installation is being made, with a large riser from an inch and a quarter pipe to two and two and a half inches, and we do not anticipate any trouble this coming winter. I believe the outside arc business is a very profitable business to any gas company, and the installation, as a rule, requires no further investment on the part of mains, service and meters, and the revenue obtained from them, as I have found from experience, is much greater than the average gas range. I should say that our outside arcs bring in a rev-

enue of about $3 a month, the majority of them. We sell our outside arc lights and have no trouble in doing so.

In connection with Mr. Chamberlain's paper, there is one point I wish to emphasize. He says that the representatives should know something about salesmanship. I believe that is a very important factor in that line of work. The representatives of the Grand Rapids Company are taking a course in the Shelton School of Scientific Salesmanship. We believe this helps to enthuse us and inspire us. There are some very good points contained in those lessons. We have not completed the course as yet, but we expect to in the near future.

In regard to representatives taking care of complaints, I believe this is a very important feature connected with the gas business. You probably all have noticed that they gather around your order window, especially on discount days. There are prboably four or five consumers who wish to register what you might call a complaint, and if he happens to be a very erratic sort of customer, and loud mouthed, and talks about robbers and thieves and so on, it is apt to have some influence on the parties who are waiting there to receive service. Whereas, if their names and number can be taken down, and a representative sent to the house, it is a much more satisfactory way to adjust the complaint on the premises of the party who is making the complaint. I believe that is very important.

Speaking of enthusiasm, we tried to have the commercial department come in contact with all other departments as much as possible. Mr. Traver brought out the point that we visit the works frequently and become acquainted with the manufacturing end of it as much as possible, but get some idea of it anyway. In fact, we tried to get the other departments enthused over this work, and I might mention a little incident which occurred a month ago with our office boy. He seems to be enthused, and to have this enthusiasm instilled in him. It came about in this way: a telephone message came in there was such and such a person who would like to see somebody and make arrangements for a gas range. The young lady who took the message, happened to tell the office boy about it. There was nobody in the office at the time to attend to it. The boy says, "Well, I will go down, I believe I can sell it," and sure enough, he took the name, went down there and closed the deal. That only shows enthusiasm and the right spirit which we are trying to bring about.

Mr. Dewey—Speaking of outside arc lighting, Mr. Cobb asked me if we had any experience with that method of casing the riser, and then running the main line pipe along the building for a number of arcs. Last winter we installed at Hudson's—or

rather last fall—I think it was a line of 8 or 10 arcs. It may be possible even a few less, but it was over five, on the northeast side of the building, a place notoriously the coldest spot in Detroit, a place which the sun rarely ever strikes. We installed them according to the system outlined in the paper, and I do not believe that even a pilot light in the coldest weather went out. On the strength of that experience, we have gone ahead and installed a great number of outside arcs on the same principle. It may be in this installation that we put in, in front of our office here, along the block there, in some cases it is defective. If it does fall down, I believe it will be on account of the peculiar conditions that you will find there. The different stores have different heights of windows. The awnings are all different, and we had to make a great many turns and bends and drops in that pipe, and we were unable to drip it all back to the riser. However, as Mr. Murray explained we are putting in encased drops into the different basements of the stores where the low point is located. I believe we will overcome the difficulty that has been mentioned of having all the lights go out at once, because, as Mr. Murray indicated, we intend to have five different risers—3 or 5—and in the line of the experience that we had at Hudson's last year, I believe we are safe in going ahead on that principle of installation of the outside light. I am aware of the fact, if we fall down, we will fall down pretty hard, because we have put all our eggs in one basket. However, I know of no better system, and we have tried pretty nearly all of them, and nearly all of the other systems have failed.

Speaking of the system tried in Kalamazoo, of hanging lights on the lamp posts, I should like to ask if the riser as it came up out of the ground in the inside of the lamp post, wasn't larger than three-quarters of an inch at the point where it came out of the ground?

Mr. Blower—No, a majority of them are ¾ inch. I think there may have been a few that were inch pipe when they turned up in the ground to run up through the lamp post.

Mr. Dewey—That is surprising, because in the light of the experience we had down at Fort Wayne, at the Army Post, where we did some outside work, we had it installed with an inch and a quarter riser that came out of the ground. It may not have been necessary, but we took that precaution.

There is another thing that has probably never been noticed by most gas companies, or gas men, and that is the depth to which frost will accumulate in a pipe. Mr. Brown of Milwaukee was relating to me an experiment which he conducted on a main pipe. I think it was an eight inch pipe, which led over one of the bridges, supplying a certain portion of the town. He had

that pipe tapped last winter, or last fall, to determine if possible the depth the frost would accumulate in that pipe, that is, the maximum depth, and he found that the depth of freezing at the coldest time did not exceed 5/8 of an inch. In other words, it seemed that the 5/8-inch covering of frost on the inside practically insulated the pipe. Acting on that idea, where we go through an area way or exposed place, we are putting in large service from two and a half to three inches, figuring that there may be possible 3/8 to 1/4 of an inch frost. That will leave an inch and a half opening in the pipe. I believe that is the reason why we find that these large services do not freeze up, from the fact that the freezing of the naphthalene, or whatever it is, accumulates to a certain depth, and from that time on the gas is practically insulated, and no more frost will deposit.

Another point. I saw in one or two of the discussions that the gentlemen used some large risers without encasing them. Our object in bringing up the encasement, was to introduce a portion of the warm air from the cellar and to keep it on the inside of the casement and outside of the riser. This was done to gradually chill the gas and conduct the moisture back to the basement. In this way, probably theoretically, we thought we would get better results, and not destroy the illuminants of the gas in any way; but either system I believe is equally satisfactory.

Mr. Cobb—I think that all of these three papers are full of good stuff, all the way through. There is just one thing in Mr. Chamberlain's paper that would lead me to believe that we, up in Saginaw and Bay City, are a little behind the times, and that is, in the use of the word complaint. Now a complaint is a complaint, and you cannot make it anything else. The consumer comes into the office with a complaint or a kick. He has made up his mind he is going to register that kick, and he naturally looks around for a place to make it. Call it information bureau, and have a clerk as information man. He comes and asks him where he can register that complaint, and he says, you can go down here or somewhere else. I don't see any reason why we should get away from the word complaint, because we all know we have any number. You can't get away from it. This is not at all in the nature of a criticism of the idea advanced, but I want a little more information as to why we should not use the word. Mr. Chamberlain says, "When a gas man, even though his desk be crowded with work, cannot listen patiently to a consumer's grievances, no matter how trivial or disagreeable, and furnish a means of adjusting the trouble, when he cannot do this as courteously and, outwardly at least, as gladly as though it were a matter of personal interest to him, he needs a vacation." That is very nice, very nice, indeed, but some years ago I should

have taken that quite literally, and think we had been up against a little hard work. Indeed I think we would all take a vacation. It is easy enough to say we should adjust the complaint, but you cannot always do it unless you adjust it the way the consumer wants you to adjust it. If a man comes in and complains of the size of his gas bills, if you are willing to cut it in half, or a quarter, he naturally will be satisfied. I think that statement should be qualified, by saying, that you must use your best endeavor to adjust the complaint satisfactorily.

Mr. Chamberlain says nothing about the use of card advertising or fancy advertising, which a great many of us have spent a good deal of money on, in the last few years. I don't know whether Mr. Chamberlain or the Grand Rapids Company have given that up, or never went into it to any great extent. Personally I think it is one of the poorest forms of advertising, but I think that Mr. Chamberlain's idea of newspaper advertising, followed up by solicitors, brings better results than any other form.

Chairman—I don't know that I can agree with Mr. Cobb on the use of the word complaint. If you use a word which implies fault,—a complaint. It is implying a fault you are establishing at once by an implied admission. It means there must be cause for complaint or you would not have a place where complaints can be registered. A consumer will come in with a complaint, and it is possible that you apply a wrong term to what he is bringing into the office. It may not properly be a complaint, and would not be a complaint if he understood what he is talking about. It is a trouble. I myself never countenance the use of the word complaint, and I won't have it around. I don't like to feel I have any complaint, and I do not want one around the office. What do you think about it, Mr. Lathrop?

Mr. Lathrop—Sometime ago I abandoned the use of the word complaint in our office for the reason you maintain. We do not like to make prominent to the people the fact that we do have complaints. I think all these papers are very valuable, and I think that one of Mr. Chamberlain's is especially valuable in the ideas that he presents that we chould make friends with the customers in every way possible.

In regard to the action of the outside arc lamps causing trouble in the winter, I do not think that we need anticipate very much trouble from them. When I was up in the northwest we had about 2,600 gas street lamps going, equipped with Welsbach burners, and the thermometers used to get away down as low as it could—got down to 40 odd degrees below zero ,and the frost used to get into the ground a good many feet, and while we did have some trouble with those lamps, we did not have

very much, and I do not see why you should anticipate a greater proportion of trouble here than we had up there.

Chairman—As the time is getting limited, and getting towards the hour of adjournment, I would ask, is there anything further that can be added?

Mr. Douglas—I would just like to say a word for Mr. Mason's paper? I think some of the gentlemen who spoke in regard to it got the wrong meaning of the paper. To me it does not mean the means of advertising gas, but gas is the means of advertising other things, as a type; and it seems to me it is the pithiest and most concisely written thing I ever saw.

Chairman—I think Mr. Mason's paper is a prime argument to use to the man to whom you want to sell an arc lamp. As such, it might very well be distributed. I am only sorry that our friend, Mr. Frost has just left, because he had quite a problem on hand in Delray. An old Frenchman came in there and asked him what the price of gas was, and he answered, $1.25 a thousand feet. He threw up his hands and says, "Well, I can't take it, I live five miles away." (Laughter).

THE REMOVAL OF NAPHTHALENE FROM COAL GAS.

By Alfred H. White and David H. Cleary*.

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*Holder of the Michigan Gas Association Fellowship in Gas Engineering at the University of Michigan.

The present paper is the fifth to be presented to your Association as the result of your support of a Fellowship in Gas Engineering at the University of Michigan. The study of the removal of naphthalene from coal gas commenced by the previous holder of the fellowship has been continued during the present year, and since the first of July has been carried on by Mr. J. M. Barnes, who holds the fellowship for the coming year. Some of the results of his tests are included in this paper. Our first paper* on the naphthalene problem, presented at your last annual meeting, was largely preliminary. Report was made of the analytic methods devised to allow the estimation of naphthalene in crude gas and tar, of the redetermination of the vapor tension of naphthalene and of experiments showing that neither water vapor, ammonia, or hydrocarbon gases exerted any unusual influence in varying the amount of naphthalene vapor which a gas could contain. Tests of the naphthalene removal in the condensing systems of four gas works were presented, but it was recognized that the methods of testing were still not completely enough developed and that the data were not sufficiently numerous to warrant drawing positive conclusions.

The very great importance of tar as an instrument for removing naphthalene was however clearly indicated, it being shown that in two works practically the whole of the naphthalene was dissolved in particles of suspended tar by the time the gas had passed the primary condenser, and that complete separation of the tar at this point also meant almost complete removal of the naphthalene from the gas. In another works, however, tests at the same point showed a relatively large amount of naphthalene remaining as vapor in the gas after the tar was separated. Unfortunately no method was known which would allow us to determine the cause of the failure of this tar to dissolve out the naphthalene. It was, of course, possible that the tar was already saturated with naphthalene and incapable of absorbing more from the gas, but there was no way of determining it.

ABSORBENT POWERS OF TAR FOR NAPHTHALENE AT DIFFERENT TEMPERATURES.

We have since worked out a method given in Appendix III, which permits the determination of the maximum amount of naphthalene which a tar is capable of absorbing from a gas under given conditions. The solvent power of a number of tars and tar distillates for naphthalene has thus been determined at sev-

*The Removal of Naphthalene from Coal Gas, by Alfred H. White and S. Ball. Proceedings Twelfth Annual Meeting of the Michigan Gas Association, September, 1904.

eral temperatures, usually 77°, 95° or 113°, and 167° F, (25°, 35° or 45°, and 72° C). The figures are given in Table I.

The results reveal that tars from various works possess different capacities for absorbing naphthalene under given conditions, a result not unexpected but never before proven. This knowledge enables us to answer in part at least one of the questions left unanswered in last year's paper. Of the works reported on last year, Ann Arbor and Grand Rapids were almost free from naphthalene trouble. Their tars show a naphthalene absorption value of 9.8 and 10.0 per cent respectively at 77° F. Jackson had occasional touches of naphthalene trouble and its hydraulic tar could only absorb 8.5 per cent. Battle Creek previous to the test had been having vexatious stoppages and its hydraulic tar could only carry 6.4 per cent naphthalene. It is evident, therefore, that the quality of the tar bears some relation to immunity from naphthalene stoppages. This is a slight gain in knowledge, but it leaves us blankly facing the larger question of the reasons for the differences in the quality of the tars. Considerable work has been done during the past year at the University of Michigan upon this point, both in small-scale distillations of coal in the laboratory and in experiments at various works. The results are, however, not conclusive and no mention is made of them in this report, which only attempts to discuss the removal of naphthalene from the gas in the condensing and purifying systems of the gas works.

Returning to Table I showing the absorbent power of various tars for naphthalene, very important information is to be gained by a study of the absorbent power of any one tar at the three different temperatures. While it has been heretofore recognized that large amounts of naphthalene were dissolved by the tar, the general impression has been that the naphthalene was separated out as the gas cooled and incidentally became dissolved in the tar present. As a necessary corollary it has also been the general opinion, even among advocates of the policy of scrubbing with tar to remove naphthalene, that the contact with cold tar was more efficient than with warm tar. Where warm tar has been used it has been with the idea of preventing loss in candle power of the gas, due to absorption of illuminants by the cold tar and not to any advantage in naphthalene removal.

Our figures, however, show the unexpected fact that the power of tar to dissolve naphthalene increases with the temperature. In all the fourteen tars tested, whether from hydraulic main, condenser or separator, there is no exception to this, and the average of all the results shows the following as the percentages of naphthalene in fully saturated tar:

TEMPERATURE.	% NAPHTHALENE.
25°C= 77°F	9.1
35°C= 95°F	16.7
45°C=113°F	21.1
72°C=161°F	48.7

TABLE I.

Absorbent Capacity of Tars for Naphthalene at Different Temperatures.

Location of works	Point of Sampling	Date of Sampling	per cent. Naphthalene in original Samples	100 Parts of Tar as Sampled Could Absorb the Following Additional Percentages of Naphthalene. 25°C 77°F	35°C 95°F	45°C 113°F	72°C 161°F	100 Parts of Saturated Tar Would Contain the Following Percentages of Naphthalene 25°C 77°F	35°C 95°F	45°C 113°F	72°C 161°F
Ann Arbor	Hydraulic	4-12-04	4.7	5.9	13.4	28.2		10.0	16.0	25.6	
Grand Rapids	Hydraulic	4-22-04	5.4	4.9	13.3	24.3		9.8	16.5	23.9	
Jackson	Hydraulic	5-12-04	4.2	4.7	16.1	18.9		8.5	17.5	19.4	
Battle Creek	Hydraulic (Tar Seal)	8-10-04	2.7	4.0	13.1	19.0		6.4	14.0	18.2	
Battle Creek	Hydraulic (Water Seal)	8-10-04	3.0	3.0	12.9	17.8		5.8	14.1	17.7	
Saginaw	Hydraulic	2- 8-05	3.3	6.4		23.1	85.0*	9.1		21.4	47.7*
Grand Rapids	Hydraulic	4- 4-05	4.8	3.2		20.0	94.8*	7.7		20.6	51.1*
Detroit	Hydraulic	5- 1-05	6.0	1.0		14.3	73.4*	6.9		17.7	45.7*
Average	Hydraulic		4.8	4.7	13.7	23.6	84.4*	9.2	15.6	23.5	48.2*
Saginaw	Well	2- 8-05	3.2	6.2		19.5	85.0*	8.8		19.0	47.7*
Bay City	Well	2-10-05	4.5	1.8		9.9	90.4*	6.1		13.1	49.9*
Grand Rapids	P. and A. Separator	4-22-04	7.9	2.9	15.0	21.9		10.5	19.9	24.4	
Grand Rapids	P. and A. Separator	4- 4-05	9.6	3.8		14.6	81.8*	12.9		21.1	50.3*
Jackson	P. and A. Separator	5-12-04	8.0	2.2	9.5	29.0		10.0	16.0	28.7	
Ann Arbor	Tar Washer	5-18-04	12.4	3.2	9.1	17.3		15.1	19.7	25.3	
	Average of all samples		5.7	3.8	12.6	19.8	85.1*	9.1	16.7	21.1	48.7*

*At the time when it is necessary to send this table to the printer the tars at 72°C are still absorbing naphthalene. The figures given must therefore be considered simply as a minimum.

It is not meant by this that in actual practice a tar would saturate itself to this limit. There will always be an equilibrium between the naphthalene dissolved in the tar and the naphthalene remaining as vapor in the gas which will prevent complete absorption of the naphthalene by the tar. The tar will absorb the first portions of the naphthalene very rapidly, and succeeding portions more and more slowly so that it would be impossible in actual gas works practice to allow time for a tar to absorb its maximum content of naphthalene from a gas at a given temperature.

It may be accepted, however, that tars can absorb more naphthalene and absorb it more rapidly at higher temperatures (up to at least 161°F), than at lower temperatures. As a necessary corollary to this it follows that a tar saturated a a higher temperature will be supersaturated at a lower temperature. This excess of naphthalene may still be mechanically held by the tar, but the union will be no stronger than if it were mixed with the same amount of sand. As illustrations, we present here several of our finished test bottles which after standing in the cooler laboratory with its changes of temperature have developed crystals of naphthalene adhering to the sides of the bottle. They are examples of how supersaturated tar may give rise to naphthalene deposits.

It is evident that if tar at 161°F can hold more than five times the amount of naphthalene which it can at 77° that for purposes of naphthalene removal it is better to scrub the gas with hot tar. This is a rather revolutionary proposition and its acceptance would compel us to recast many of our usual theories of naphthalene removal, and possibly to radically revise the practice of naphthalene removal as well. This theory of the powerful influence of hot tar affords the only satisfactory explanation of the enormous removal of naphthalene from the gas in the standpipe and hydraulic main. If we apply this theory in explanation of the removal of naphthalene in the gas works, we find that the tar vapors condensing into minute globules possess enormous surface so that the rate of absorption of naphthalene will be rapid. Further, at the higher temperatures of the standpipe the amount of naphthalene which the tar can hold is several times as large as when it leaves the condensers, so that the equilibrium between the naphthalene in vapor and naphthalene in tar at the higher temperatures will show a much larger proportion of naphthalene in the tar. Both these conditions will favor the rapid and almost complete removal of the naphthalene at the higher temperatures. It indicates that most of the naphthalene removal should be accomplished before the gas leaves the hydraulic main and suggests the possibility that if the amount of naphthalene is large

that the tar may actually become supersaturated as it cools, and give back to the gas the naphthalene which it had previously removed at a higher temperature.

Another point is also indicated as to the interpretation of results of our tests made both last year and during the present year. In sampling from standpipes, hydraulic mains, etc., the gases are cooled down very materially as they pass through the glass tube filled with asbestos which filters out the tar. Wherever possible, these glass tubes were inserted inside the main to avoid cooling, but sometimes they had to be placed outside. In our preceding paper, we regretted that we could not estimate the influence exerted by this scrubbing of the gas with the cold tar. It is now evident that the influence of scrubbing with cold tar is relatively slight. If we tap a standpipe and pass the vapors through an asbestos filter which cools them and strains out the tar, it is unlikely that the tar will extract much more naphthalene from the gas in view of its greatly diminished solvent power for naphthalene at the lower temperature and its vastly decreased surface from that which it had when it existed as minute globules floating in the gas. The proportions of naphthalene found by analysis in the separated tar and in the gas should then give a fairly correct idea of the conditions actually existing in the pipe which has been tapped. This knowledge gives us much greater certainty in our interpretations of the results of tests.

DIVISIONS OF THE CONDENSING SYSTEM.

The condensing systems of most gas works may be divided for the purposes of study into two divisions, one ending with the P. & A. or other form of separator, and the other with the scrubber. In the first division the gas is gradually and quietly cooled in the hydraulic, foul main and primary condenser. In the tar separator and the exhauster the gas is violently agitated and forced through small openings and against walls everywhere dripping with tar. Emerging from this vigorous treatment, it enters the second division of the condensing plant, being quietly and gradually cooled in the secondary condenser to be subjected again to vigorous agitation and scrubbing in some form of washer or scrubber, but this time in presence of a relatively large amount of water, which soon becomes ammoniacal.

Our study of naphthalene removal has been made at the terminal points of these divisions and therefore will be discussed with reference to conditions at:

1. The top of the standpipe.
2. The P. & A. tar separator.
3. The scrubbers.

CONDITIONS AT THE TOP OF THE STANDPIPES.

The details of the method of sampling are given in Appendix

II. It is sufficient here to note that the gas was slowly drawn through a weighed glass tube containing asbestos to filter out the suspended tar and then through picric acid to take out the naphthalene vapor from the gas. The gas was collected in a one-third cubic foot aspirator at such a rate as to fill the aspirator in an hour. When an aspirator was full a fresh absorption train and aspirator was substituted for the previous one, so that an average result was obtained for each hour. In addition to these tests, memoranda were made of kind of coal used, weight of charge and temperature of retort at time of drawing coke. The temperature was obtained by a Morse, or Holborn-Kurlbaum, optical pyrometer, modified slightly to suit our needs, which proved an easily portable and sufficiently accurate instrument. In this way data were collected in five works, twenty-one separate charges being tested in all. Unfortunately, not all of these tests are perfect, and although valuable corroborative testimony may be drawn from an incomplete test, it does not seem advisable to present such in detail. Two tests will be presented in full and the others summarized.

The most uniform series of results were obtained in Detroit, where on successive days simultaneous tests were made on a lower retort and the one above it in a bench of eight. Four results were thus obtained which are especially valuable because the retorts were charged by machinery, and thus probably more uniformly than would have been the case with hand charging. The temperatures were also all very close together, the maximum variations of retort temperature at time of drawing the charge being only twenty-five degrees. These results are so nearly uniform that it is possible and advantageous to average them. The average result is given in Table II. Another complete and satisfactory test selected for presentation was made at Ann Arbor, where closely agreeing results were obtained on successive charges of the same retort. These two tests are averaged in Table III.

These tests are selected for presentation because they are the most complete and, so far as we know, are representative of the usual practice at these works. The conditions at the two works are widely different. Detroit has larger retorts and runs heavier charges for a longer time at lower heats. The coal of the two works is supposedly from the same district, but it would not be safe to assume that therefore it could be considered as identical. Each of the differences at the two works must exert its influence upon the nature of the products, and since the influence of each difference is almost entirely a matter of surmise, comparisons of the two works must be made cautiously. It is unfortunate that it was impossible to determine the amount and quality of gas during the tests or the rate at which it was evolved.

TABLE II.

Data of Standpipe Tests at Detroit.

Conditions of Tests.—Average of four similar tests on two retorts in a bench of eight, one retort being a bottom one and the other the one above it. Retorts 10'x27"x30". Charge 460-500 pounds Youghiogheny coal charged by machine. Duration of heat 4½-5 hours. Temperature at time of drawing coke 925°-950°C (1700°-1745°F). Date of tests May 1 and 2, 1905.

Products per Cubic Foot of Gas in Each Hour.

(a) By weight in grams.

	Tar and Water	Water	Anhydrous Tar	Naphthalene			Free Carbon in Tar
				in Gas	in Tar	Total	
1st hour	14.924	7.724	7.200	.0213	.4001	.4214	2.457
2nd hour	9.884	3.900	4.984	.0172	.3766	.3938	1.944
3rd hour	5.020	1.616	3.404	.0154	.2449	.2603	1.578
4th hour	2.312	.724	1.588	.0137	.1205	.1342	.769
Av. per Cubic Ft.	8.035	3.741	4.294	.0169	.2855	.3024	1.687

(b) By percentage.

	Proportion of Tar for each hour	Composition of Tar		Composition of Anhydrous Tar		Proportion of Naphthalene	
		Water	Anhydrous Tar	Naphthalene	Free Carbon	Dissolved in Tar	As Vapor in Gas
1st hour	46.4%	51.8%	48.2%	5.8%	33.6%	95.0%	5.0
2nd hour	30.8%	45.6%	54.4%	7.3%	39.0%	95.7%	4.3
3rd hour	15.6%	32.2%	67.8%	7.6%	46.4%	95.7%	4.3
4th hour	7.2%	31.4%	68.6%	8.4%	48.4%	89.9%	10.1
Av. per Cubic Ft.		46.5%	53.5%	6.6%	39.3%	94.5%	5.5%

TABLE III.

Data of Standpipe Tests at Ann Arbor.

Conditions of Test.—Average of two successive tests on one middle retort in a bench of six. Retorts 9'x16"x28". Charge about 285 pounds of Youghiogheny coal. Temperature at time of drawing coke 1035°C (1895°F).

Products per Cubic Foot of Gas in Each Hour.

(a) By weight in grams.

	Tar and Water	Water	Anhydrous Tar	Naphthalene			Free Carbon in Tar
				in Gas	in Tar	Total	
1st hour	22.341	9.299	13.042	.0124	.4144	.4268	4.263
2nd hour	6.951	2.436	4.515	.0078	.3162	.3240	1.365
3rd hour	3.106	.781	2.325	.0153	.2340	.2493	.804
4th hour	.591	.057	.534	.0135	.0480	.0615	.348
Av. per Cubic Ft.	8.247	3.143	5.104	.0122	.2531	.2653	1.695

(b) By percentage.

	Proportion of Tar for each hour	Composition of Tar		Composition of Anhydrous Tar		Proportion of Naphthalene	
		Water	Anhydrous Tar	Naphthalene	Free Carbon	Dissolved in Tar	As Vapor in Gas
1st hour	67.7	41.6	58.4	3.2	32.6	97.1	2.9
2nd hour	21.0	35.1	64.9	7.0	30.2	97.6	2.4
3rd hour	9.4	25.2	74.8	10.0	34.6	93.7	6.1
4th hour	1.8	9.7	90.3	9.0	65.1	78.1	21.9
Av. per Cubic Ft.	....	38.1	61.9	5.2	33.2	95.4	4.6

Considering the difference in conditions at the two works, the average weights of products per cubic foot of gas on four hours' run are remarkably close together. The average amounts of tar, water, naphthalene and free carbon differ little in the two works. On comparing them hour by hour, the influence of the lighter charges and higher temperatures at Ann Arbor is shown by the larger proportion of tar the first hour. At Ann Arbor over two-thirds of the tarry products are evolved the first hour, while in Detroit less than half are. The proportions fall rapidly in the later hours so that in Ann Arbor less than two per cent are evolved in the fourth hour, while at Detroit the amount is four times as great.

Further general discussion of these results might be interesting, but would almost necessarily be largely speculation. The subject involves the whole question of destructive distillation of coal and it will require many more tests made under carefully regulated conditions before any attempt can justly be made to assign even an approximate value to the many variables in the problem. The particular problem under consideration in this paper is the removal, not the formation of napthalene, and, fortunately, the data on this point are sufficiently concordant to allow us to generalize. Referring to these two tests and considering them hour by hour, it will be noted that the naphthalene is evolved continuously through the whole process of distillation. The largest amount is evolved during the first hour, and the decrease is continuous in succeeding hours. The amount is roughly in proportion to the amount of tar produced in the corresponding periods. In the first hour at Detroit the naphthalene amounted to about six per cent of the anhydrous tar and in the last hour to about nine per cent, with a gradual increase in between. At Ann Arbor the difference was more marked, the increase being from three and one-half per cent the first hour to eleven per cent the last.

More important than these figures, however, are those relating to the division of the naphthalene between the tar and the gas. It will be remembered that the method of sampling at the top of the standpipe involves the filtration of the gas through asbestos to remove the mechanically suspended tar. Considered hour by hour, the results are concordant for the first three hours, the amount of naphthalene removed from the gas being close to ninety-five per cent. In the fourth hour at both works the percentage drops, but the absolute amount in the fourth hour is so small that it affects the average only slightly. At both Ann Arbor and Detroit the average during the four hours shows practically ninety-five per cent of the naphthalene dissolved in and capable of being filtered out with the tar at the top of the standpipe.

These conditions at Ann Arbor and Detroit are not exceptional. Experiments at other works have frequently shown as high a percentage. The lowest figure we have ever found is eighty-one per cent, and the average of all our tests shows ninety-one per cent of the naphthalene held dissolved by the tar at the top of the standpipe. The average weight of naphthalene shown by our experiments is 349 milligrams per cubic foot of gas, and of this amount all but 31 milligrams are dissolved in the tar at this point. This seems a tremendous influence for the tar to exert in the few seconds while the gas is ascending the standpipe, but it must be remembered that the tar and naphthalene are formed simultaneously as vapors and condense together so that there is every opportunity for the tar to rapidly absorb a part of the large amount of naphthalene which our experiments indicate it can carry at the temperature of the top of the standpipe.

For our present purpose, the net results of our standpipe tests may be considered to be the knowledge that *ninety per cent of the naphthalene is dissolved by the tar before the gas leaves the standpipe.* From this point to the tar separator the change is relatively slight. The gas remains in the hydraulic, foul main and primary condenser much longer than in the standpipe, but owing to the lower solubility of naphthalene in tar as the temperature drops the removal of naphthalene is slower though still important. Our experiments show an average of eleven milligrams of naphthalene as vapor in the gas at the outlet of the primary condenser as compared with thirty-one at the top of the standpipe. This eleven milligrams of naphthalene still in the gas at the outlet of the primary condenser would be sufficient to saturate the gas at a temperature of 64°F (18°C). The actual temperature at this point is usually above 100°F (38°C). At that temperature the gas could hold practically seven times as much naphthalene as at 64°F, so that the gas leaves the condenser containing only a small proportion of the total amount of naphthalene which it could hold at that temperature. The highest percentage of saturation we have ever found at this point was 17.6 per cent. This effectually disposes of any lingering idea that it was the lowering in temperature which had thrown out the naphthalene, because in that case the gas must have been completely saturated when it left the condenser.

THE P. & A. TAR SEPARATOR.

In most works the gas passes from the primary condenser to a tar separator usually of the Pelouze and Audouin type. We have made nine tests in seven different works to determine the effect of the P. & A. tar separator. The method of making the tests is given in detail in Appendix II, where also are to be

TABLE IV.

Summary of Tests at the Inlet and the Outlet of the P. and A. Tar Separator.

(All weights are in grams per cubic foot of gas.)

Location of Works	Temp. °F		Weight of Tar and Water		Weight of Anhydrous Tar		Percentage Naphthalene in Anhydrous Tar		Weight of Naphthalene						Percentage of Naphthalene Saturation in Gas		Temperature of Naphthalene Deposition °F	
									Total		In Tar and Water		In Gas					
	In*	Out*	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Battle Creek	108	72*	2.41		.95		8.6		.091	.005	.082	.004	.003	.001	2.5	8.4	43.	36.
Port Huron	136	130	4.12	2.28					.095	.012	.071	.007	.024	.005	6.1	1.9	76.	52.
Grand Rapids	96	106	1.58		.95		5.2		.060		.049		.011	.001	1.8	.4	64.	34.
Detroit, 11-'04	116	108	2.24	1.43	1.06	.32	13.0	13.3	.165	.051	.139	.043	.026	.008	17.6	6.7	79.	58.
Detroit, 5-'05	117	113	2.41	1.19	1.08	.36	10.1	12.1	.111	.043	.109	.043	.002	trace	1.4	0.	40.	0.
Ann Arbor, 7-'04	112	86											.015	.003	12.2	8.4	69.	45.
Ann Arbor, 8-'04	110	90	2.77	.13	1.61		8.4		.140	.013	.136	.011	.004	.002	3.2	3.2	48.	37.
Ann Arbor, 7-'05	106	105	1.69	.63	.57	.06	10.4		.061		.059		.002	.002	1.9	1.9	37.	39.
Jackson, 8-'05	94	92	1.23	.39	.61	.04	8.7	9.0	.057	.006	.054	.004	.003	.003	5.1	4.8	44.	42.

*These samples were taken as near to the P. and A. as plugs could be found. In some cases the distance was enough to cause considerable drop in temperature between the "inlet" and "outlet" readings, and at Battle Creek the "outlet" tests are as far away as the outlet of the secondary condenser.

found the detailed tables of the tests. A summary is given in Table IV.

As indicated in the preceding section, there is only a comparatively small amount of naphthalene in the gas as it comes to the tar separator. The chief function of the tar separator is to separate a large portion of the mechanically suspended tar and water. The figures as to the per cent of tar removed by the separator are not complete for all the plants, but the average of five tests shows 58 per cent of tar removed. The tar emerging does not possess the same composition as that entering. The chief difference is in the percentage of water in the tar, which has increased from 58 to 79 per cent in the three cases where this test was made. Eliminating this water and calculating to anhydrous tar, we find that the separator has taken out 73 per cent of the anhydrous tar.

We would also expect a small change in the composition of the anhydrous tar. The theory of such a separator being that if a sudden change of direction be given by a baffle plate to a gas stream carrying particles of liquid, the greater momentum of the particles of liquid will carry them against the baffle plate, to which they will adhere, it is natural to expect the partial removal of the denser tars. An indication of such a change is found in the three tests which are complete enough to show it. Two were made at the Detroit works, but with an interval of six months between them, and both show an increase in the amount of naphthalene in the tar leaving the separator. In one case the increase is too small to be conclusive, but in the other the naphthalene in the anhydrous tar rises from 10.1 to 12.1 per cent, an increase altogether too high to be attributed to the few milligrams absorbed from the gas. In the Jackson tests there is also a similar though slight increase.

If the action of the separator is a purely mechanical one, it might be expected that the gas would emerge from the separator having just the same amount of naphthalene as when it entered. The emerging gas holds, however, less naphthalene in every case but two, and there the total amount present is so small as to make it difficult to estimate it correctly. The average amount of naphthalene per cubic foot of gas has fallen from 10.9 to 2.7 milligrams. The removal of naphthalene by the tar in the P. & A. must be laid to the agitation of the gases affording a better opportunity for the gases and the globules of tar to come in contact with one another. A parallel case may be found in another industry, in the manufacture of sulphuric acid, where it has long been known that the reaction between the gases and suspended liquids was accelerated by the mixing they got while passing from one chamber to another.

The amount of naphthalene remaining in the gas as it leaves the separator is so small that there is not a sample of gas from any works which we have tested which, had it been perfectly freed from tar, would not have stood cooling to 50°F (10°C) before it would have deposited naphthalene. Most of them could have been chilled to 40°F (5°C) before any deposit of naphthalene could form. In other words, if the P. & A. separator had removed absolutely all the tar, the gas would have passed through the works without a possibility of a stoppage and most of it would have stood the coldest winter weather with hardly an appreciable naphthalene deposit. While this beatific condition prevailed at the outlet of the P. & A., simultaneous tests of the gas passing out of the scrubbers in the same works often showed a dangerous amount of naphthalene in the gas and sometimes actual stoppages were being found within the works. To understand this anomalous state of affairs, it is necessary to study carefully the reactions taking place in the scrubbers.

THE SCRUBBERS.

The purposes of the scrubbers are two-fold. In the first place, they are to remove all the fine particles of tar which escaped the P. & A. and did not separate of their own accord in the secondary condenser. It is almost necessary in order to accomplish this that the gas be scrubbed with some liquid. Water is universally used because it not only permits the effectual removal of the tar, but also in the same apparatus takes out the ammonia and part of the hydrogen sulphide. The form which the apparatus takes is entirely immaterial for our purpose. For our purpose the scrubbers are considered to commence as soon as the gas is brought into contact with the water.

We have a record of five tests in four different works in which results are given of the conditions at the inlet and outlet of the scrubbers. There are other partially incomplete tests which corroborate the evidence. These tests without exception show an increase in naphthalene as the gas passes through the scrubbers, an increase which in some cases is large enough to threaten trouble. The first thought is that gas has been picking up naphthalene deposited there at some previous period when the works were not running well. Such was our first impression, and it was only as instances increased and no exceptions were found that the conviction was forced upon us that there must be some systematic underlying cause to bring about this universal increase in the amount of naphthalene held by the gas as it leaves the scrubbers.

Since the synthesis of naphthalene in the scrubbers is out of the question, it follows that the naphthalene must have been introduced from the only possible outside source—the tar carried

in suspension by the gas. This tar, calculated to a water-free basis, has been found to contain as high as twenty-five per cent naphthalene, which would mean that it is completely saturated. Its amount will vary with the equipment and policy of the works. One test at Ann Arbor showed only forty-five milligrams of anhydrous tar per cubic foot of gas at the commencement of the scrubbing system (inlet of box washer), while a similar test at Detroit showed nearly four times as much. The Ann Arbor tar carried about ten and the Detroit tar twenty-six per cent naphthalene. The latter must have been fully saturated, nevertheless, no appreciable amount of naphthalene was to be found in the gas at this point in either works.

Simultaneous tests at the outlet of the scrubbers showed a different state of affairs. At Ann Arbor the gas had picked up 2.5 milligrams naphthalene per cubic foot, an amount too small to give any trouble, for the gas would have had to be cooled to 42°F (5°C) before any naphthalene would have been chilled out. At Detroit, however, the gas had absorbed 9.5 milligrams, which would cause it to be saturated at 62°F (17°C). The outlet temperature was actually 73°F, so the gas was not entirely saturated, but there was also present suspended naphthalene removed by our asbestos filter to the extent of 8.6 milligrams per cubic foot. The time since the gas had come in contact with the naphthalene had evidently been too short to allow the gas to saturate itself. The total amount of naphthalene carried per cubic foot of gas was 18.1 milligrams, which would have been sufficient to saturate the gas at 72°F (22°C). The influence of the iron oxide purifier mentioned in our report a year ago was also evident here, the amount of naphthalene in the gas leaving the purifiers being only 5.6 milligrams, corresponding to a saturation temperature of 53°F. The Detroit test must have represented an abnormal condition in the works, for otherwise naphthalene stoppages would have been inevitable, and only trivial ones were being encountered.

A test at Port Huron gave similar results. There the gas entered the scrubbers with almost no naphthalene, (saturation temperature 34°F), and left them with a saturation temperature of 52°F, but carrying three times as much naphthalene in suspension as was contained in the vapor form. The total amount of naphthalene would have been sufficient to saturate the gas at 74°F. However, inasmuch as three-fourths of the naphthalene was in the solid form, it separated in the first dead space and formed deposits, giving rise to frequent stoppages between the scrubbers and purifier.

This explanation of the origin of solid naphthalene in the scrubbers accounts satisfactorily for the hitherto puzzling phe-

nomenon of its appearance in and deposition from a gas which was not saturated with it. The mechanically suspended naphthalene is deposited at once in dead corners of the works, mains and purifying boxes, where, owing to the small circulation of gas, it remains even though the gas may be passing on only partially saturated. This was the case at Port Huron, where the stoppages were almost entirely confined to the scrubbers and the pipes between the scrubbers and purifiers. At no place in the works, however, was the gas over fifty per cent saturated, so the phenomenon was for a time hard to explain.

Results of other tests at Grand Rapids and at Detroit, new plant and old plant, show an increase of naphthalene in the gas leaving the scrubbers. The amount of naphthalene is in some cases too small to cause trouble and under such circumstances is advantageous in increasing the candle power. A summary of these tests is given in Table V.

TABLE V.

Summary of Tests on Naphthalene in Gas at Various Points of the Condensing System.

	Naphthalene in Gas mgms. per cu. ft.	Temperature of Naph. Deposition
Battle Creek; 8-9-04.		
(For further data see Appendix I, Table VI.)		
Primary condenser outlet	2.7	43°F.
Secondary outlet	1.6	38
Holder outlet	11.2	65
Port Huron; 8-31-04.		
(For further data see Append. I, Table VII.)		
P. and A. inlet	23.5	77
Condenser inlet	5.1	52
Scrubber inlet	.8	34
Scrubber outlet	4.7	51
Detroit (new plant); 11-4-04.		
(For further data see App. I, Table VIII.)		
Primary condenser outlet	26.3	79
Third condenser inlet	4.8	51
Rotary washer outlet	16.0	71
Purifier outlet	5.7	53
Detroit (new plant); 5-3-05.		
(For further data see App. I, Table IX.)		
Primary condenser outlet	2.2	42
Third condenser outlet	0.	0
Rotary washer outlet	9.5	62
Grand Rapids; 4-4-05.		
(For further data see App. I, Table X.)		
Primary condenser outlet	11.3	62
Washer cooler inlet	.5	32
Washer cooler outlet	1.1	35
Ann Arbor;		
6- 6-04 Primary condenser outlet	15.5	69
Secondary condenser inlet	3.2	45
7-22-04 Primary outlet	3.8	46
Secondary inlet	1.5	38
7- 8-05 Inlet P. and A.	1.5	38
Outlet P. and A.	2.0	40
7-12-05 Box-washer inlet	0.	0
Rotary scrubber outlet	2.5	42
(For further data see App. I, Table XII.)		

It is then evident that the gas takes up naphthalene from the tar in the scrubbers. The only possible explanation is that the tar has become supersaturated with naphthalene. There is

usually no drop in temperature in the scrubbers sufficient to account for this, and agitation with water should cause no measurable change, although there is a slight theoretical one to be expected. The only other agent to be considered is the ammoniacal liquor. Should this dissolve out from the tar some constituent which is an especially good solvent for naphthalene, it might cause the remainder of the tar to become supersaturated and allow naphthalene to be set free. The phenols are such solvents of naphthalene. They are also acidic enough in nature to react with ammonia and form salts considerably more soluble in water than the phenols themselves. It is then a plausible hypothesis that the ammonia liquor might dissolve out phenols and cause the naphthalene previously dissolved in them to return to the free state. Proof that the ammonia liquor does dissolve phenols has been afforded by direct determination of the phenols in the ammoniacal liquor from the scrubbers at Ann Arbor and Detroit. The method is given in Appendix IV. Analysis shows that these ammoniacal liquors contain a little over three-tenths of one per cent of phenols, which corresponds to about forty milligrams of phenols to the cubic foot of gas. If these phenols should contain only twenty-five per cent of their weight of naphthalene, it would be sufficient to saturate the gas at 62°F. It is probable that naphthalene would be thus liberated even from an unsaturated tar, for a tar when cold and already containing considerable naphthalene absorbs more very slowly. In the scrubbers the tendency would be for the separated naphthalene to rise to the top of the water and for the tar to sink to the bottom, thus effectually preventing their interaction. The only test which we have made of saturation of a tar washer tar was one from Ann Arbor, which contained 12.4 out of a possible 15.1 per cent of naphthalene which it could hold at 77°F. There is no question but that in the case of a tar so fully saturated as that one, that further absorption of naphthalene would proceed at an extremely and, for our purpose, negligeably slow rate.

SUMMARY OF THE REACTIONS IN THE CONDENSING SYSTEM.

If we now turn from our consideration of the separate divisions of the condensing system and consider it as a whole, we find that in the hot standpipes and warm hydraulic and foul mains, the naphthalene is readily dissolved by the tar. Provided time enough is given in this stage of the process, the gas will come to the tar separator entirely free from any measurable amount of naphthalene other than that held dissolved by the suspended tar. The old practice of slow and gradual cooling was right, although based upon a misconception of its purpose. Viewed from the standpoint of naphthalene removal, the advantage of slow

cooling is that it keeps the gas a longer time at a higher temperature and thus favors the solution of the naphthalene by the tar. A secondary advantage is that in slow cooling the particles of tar vapors separate as globules large enough to be more readily removed by the tar separator than the fine mist which would result from a rapid chilling of the gas. Provided conditions for condensation have not been favorable in the foul main, the gas comes to the tar separator still containing naphthalene vapors.

The tar separator by mechanical action removes most of the suspended tar. Through the agitation it gives the gas and the tarry surfaces it presents, it may also remove part of the naphthalene vapor from the gas. The suspended tar particles still continue their action on the naphthalene vapor in the following condensers, although the action is much slower as the tars are becoming nearly saturated at the lower temperatures.

The scrubbers by thorough churning with water remove the last of the suspended tar, as also the ammonia and some other constituents. But, unfortunately, the ammonia also dissolves phenols from the tar, thus liberating the naphthalene held dissolved by them. If, as is apparently the case, the undissolved portion of the tar is already nearly saturated with naphthalene, this liberated from the phenols remains in the free state and, floating on the water of the scrubber, is taken up mechanically or as vapor by the gas. That mechanically suspended is partially stopped by the purifiers and also some of that held as vapor is apparently removed, although the capacity of the purifiers is limited in this regard, unless revivification by exposure to the air is frequent. This liberation of naphthalene by the ammonia in the scrubbers is apparently the most frequent source of naphthalene trouble.

PREVENTION OF NAPHTHALENE STOPPAGES.

From what precedes it is evident that there may be two causes of naphthalene deposits:

1. The tar is not dissolving all the naphthalene.
2. The tar is giving back part of the naphthalene already dissolved.

Trouble from the first cause will be lessened if the foul main be made large so that the gas will be kept hot until the tar has had time to remove the naphthalene. Whether or not this simple remedy would be sufficient in all cases cannot be told off-hand. The hydraulic tars tested have never contained more than twenty-five per cent of the maximum they could take up at 113°F (45°C), nor more than ten per cent as much as they could hold at 165°F (72°C), so that it seems reasonable that with a sufficiently long contact at these temperatures the tar should be able to remove substantially all the naphthalene under any except very

abnormal conditions. The tar might not be able to retain all the naphthalene, however, until it was cold, for although we have not met a hydraulic tar which was much over fifty per cent saturated, even when cooled to as low as 77°F, we have found lighter separator tars seventy and even eighty per cent saturated at the same temperature. It is, therefore, possible that even with most careful treatment the tar might not always be able to dissolve all the naphthalene from the gas and retain it, but the probabilities are that in most cases it could do so.

Trouble from tar giving back naphthalene to the gas will evidently arise if the tar by cooling becomes supersaturated before it is separated from the gas. As mentioned previously, this is a case we have never met. The only trouble which we have met from this source has been in connection with the solvent action of ammonia in the scrubbers. If the tar is completely separated before the gas gets to the scrubbers. it is self-evident that there can be no trouble from this source. The tar separator should, therefore, be set to remove the tar as completely as possible.

If there is naphthalene vapor in the gas after all the tar is separated, it is possible by chilling to throw it out and mechanically separate it, but the method is unsatisfactory. A more convenient method is the one, proposed in several modifications by different inventors, of scrubbing the gas with tar or tar distillates. From what has preceded it will be plain that so long as the tar or oil is not already nearly saturated with naphthalene the result can be readily achieved. Viewed merely from the standpoint of naphthalene removal and without any reference to effect on candle power, it is immaterial what particular distillate is used. Any one may be used, although some will be better than others. They will all work better and absorb more naphthalene when used warm than cold, but all will ultimately become saturated and require renewal. The oil scrubber should be the last in the series, as then it will only have to remove the naphthalene which has passed the fresh water scrubber, and will not be fouled by suspended tar.

TABLE VI.

Data of Tests on Condensing System of Battle Creek Gas Works.
(All weights are in grams per cubic foot of gas.)

Point of Sampling	Date 1904	Temp. °F	Weight of Tar and Water	Weight of Anhydrous Tar	Percentage of Naphthalene in Anhydrous Tar	Weight of Naphthalene			Percentage of Naphthalene Saturation in Gas.	Temperature of Naphthalene Deposition °F
						Total	in Tar and Water	in Gas		
Hydraulic Main Tar Seal	8-9-A M		4.40			.153	.099	.054		93
	8-9-P M		4.81			.114	.080	.034		84
	8-10-A M		3.85	2.18	2.3	.103	.052	.051		92
Hydraulic Main Water Seal	8-9-A M		2.66	1.13	7.7	.119	.087	.032		83
	8-9-P M		3.20	1.19	4.5	.108	.054	.054		93
	8-10-A M		2.88	1.08	4.7	.105	.051	.054		93
Primary Condenser Outlet	8-8-P M	110	2.35	.57	14.7	.089	.084	.005	3.9	50
	8-9-A M	98	2.16	.57	13.3	.080	.076	.004	6.4	50
	8-9-P M	108	2.41	.59	14.0	.085	.082	.003	2.5	43
Secondary Condenser Outlet	8-8-P M	70	.42			.009	.007	.002	13.5	40
	8-9-A M	70				.005	.004	.001	8.4	36
	8-9-P M	72				.006	.004	.002	9.2	38
	8-10-A M	72						.005	28.3	51
Holder Outlet	8-9-P M							.011		65

REMARKS.—In this works the gas goes through the primary condenser, exhauster, P. and A., secondary condenser and two tower scrubbers.

TABLE VII.

Data of Tests on Condensing System of Port Huron Gas Works.

All weights are in grams per cubic foot of gas.

Point of Sampling	Date 1904	Temp. °F.	Wght of Tar and Water	Weight of Naphthalene			Percentage of Naphthalene Saturation of Gas	Temperature of Naphthalene Deposition °F.
				Total	in Sep'd Tar and Water	in Gas		
Hydraulic Main	8-30-PM	176	4.68	.077	.065	.012		66
	8-30-PM	172	6.74	.109	.088	.021		74
P. and A. Separator Inlet	8-31-AM	136	4.12	.094	.071	.023	6.9	76
Condenser Inlet	8-30-PM	128	1.59	.013	.006	.007	2.9	58
	8-31-AM	130	2.28	.013	.008	.005	1.9	52
Scrubber Inlet	8-30-PM	100	1.01	.031	.030	.001	1.3	34
	8-31-AM	94	.85	.046	.045	.001	1.4	34
Scrubber Outlet	8-31-AM	80	.19	.025	.020	.005	18.3*	52*
	8-31-AM	82	.06	.014	.009	.005	15.5*	51*
Purifier Inlet	8-31-PM	80	.13	.018	.014	.004	15.0*	49*
	8-31-PM	80	.24	.021	.015	.006	20.5*	53*
Purifier Outlet	8-31-PM	80		.005		.005	20.1	53
	8-31-PM	80		.002		.002	8.4	41

*At the scrubber inlet and beyond, tar was practically absent, the naphthalene under the heading, "in separated tar and water," being mostly in the free crystalline state. If the total naphthalene be considered to be in a state where it could have been absorbed by the gas, and had it passed completely into the vapor state, it would have saturated the gas at 72°F. As it was, it separated out in part, forming deposits between the scrubber and purifier.

REMARKS.—In this works the gas goes from a rather long foul main to the exhauster and the P. and A. tar separator, then to the condenser and scrubber.

TABLE VIII.

Data of Tests on Condensing System of Detroit Gas Works. Station A. New Plant.
All weights are in grams per cubic foot of gas.

Point of Sampling	Date 1904	Tem. °F.	Wght of Tar and Water	Wght of Anhydrous Tar	Percent'g Naphthalene in Anhydrous Tar	Weight of Naphthalene			Percentage of Naphthalene Saturation in Gas	Temp. of Naph. Deposition °F
						Total	in Tar and Wat'r	in Gas		
Standpipe	11-4 AM	302	8.98	5.27	5.9	.338	.313	.025		78°F
	11-4 AM	320	7.73			.316	.273	.043		88
1st Condenser Outlet	11-3 AM	120	2.37	1.06	13.7	.172	.145	.027	15.0	80
	11-4 AM	112	2.12	1.06	12.4	.158	.132	.026	20.1	79
2d Condenser Inlet	11-3 PM	115	1.80	.38	12.4	.057	.047	.010	6.9	63
	11-4 AM	102	1.06	.25	15.2	.043	.038	.005	6.5	53
3d Condenser Inlet	11-3 PM	90				.074	.069	.005	10.2	51
	11-4 AM	84	1.03	.39	16.6	.074	.065	.005	13.8	51
Box Washer Inlet	11-4 PM	76						.010	46.4	63
	11-5 AM	76						.015	65.9	69
Rot'y Washer Outlet	11-4 PM	60						.016	supersaturated	71
	11-5 AM	60						.018	supersaturated	72
Purifier Outlet	11-5 AM -AM	60						.006	67.8	53

REMARKS.—In this works the gas goes through a primary condenser, exhauster, P. and A. tar separator, second and third condensers, box washer and rotary washer.

TABLE IX.

Data of Tests on Condensing System of Detroit Gas Works. Station A. New Plant.
All weights are in grams per cubic foot of gas.

Point of Sampling	Date 1905	Tem. °F	Wght of Tar and Water	Weight of Anhydrous Tar	Percentage Naphthalene in Anhydrous Tar	Weight of Naphthalene			Percent'ge of Naphthalene Saturation in Gas	Temp. of Naph. Deposition °F.
						Total	in Tar and Water	in Gas		
1st Condenser Outlet	5-3 AM	120	2.42	1.09	10.4	.117	.114	.003	1.6%	44°F
	5-3 PM	114	2.40	1.08	9.6	.106	.104	.002	1.2	40
2d Condenser Inlet	5-3 AM	116	1.25	.34	13.5	.046	.046	trace	.0	0
	5-3 PM	110	1.13	.36	11.4	.041	.041	trace	.0	0
3d Condenser Inlet	5-3 AM	90	.46	.11	24.5	.028	.028	trace		
	5-3 PM	86	.36					trace	.0	0
Box Washer Inlet	5-3 AM	72	.28	.16	26.7	.043	.043	trace	.0	0
	5-3 PM	71				.020	.020	trace	.0	0
Rot'y Washer Outlet	5-3 AM	72	.04			.017	.008	.009	53.0	61*
	5-3 PM	74	.06	.01	100.	.020	.010	.010	49.7	63
Purifier Outlet	5-2 PM	104						.006	6.1	53
	5-2 PM	104						.006	6.3	53

*At the rotary washer outlet, tar was practically absent, the naphthalene under the heading, "in tar and water," being mostly in the free crystalline state and visible as such. If the "total naphthalene" be considered to be in a state where it could have been absorbed by the gas, and had it passed completely into the vapor state, it would have saturated the gas at an average of 73°F instead of 62°.

TABLE X.

Data of Tests on Condensing System of Grand Rapids Gas Works.
All weights are in grams per cubic foot of gas.

Point of Sampling	Date 1905	Temp. °F.	Weight of Naphthalene in Gas	Percentage of Naphthalene Saturation of Gas	Temperature of Naphthalene Deposition °F
Primary Condenser Outlet	4-4 AM	96	.016	2.6%	71°F
	4-4 PM	97	.007	1.0	56
Washer Cooler Inlet	4-4 AM	110	.001	.8	34
	4-4 PM	103	trace	.0	0
Washer Cooler Inlet to Last Section	4-4 AM	74	.002	7.3	37
	4-4 PM	75	.003	12.1	42
Washer Cooler Outlet	4-4 AM	72	.002	10.4	38
	4-4 PM	70	.001	2.6	32
Holder Inlet	4-5 AM	65	.011	100.	65
	4-5 AM	65	.013	supersaturated	68

REMARKS.—In this works the gas goes from the primary condenser through the exhauster to the P. and A. separator, then to the washer-cooler (a combined condenser and scrubber) and then to the purifiers.

TABLE XI.

Data of Tests on Condensing System of Detroit Gas Works. Station A. Old Plant.
All weights are in grams per cubic foot of gas.

Point of Sampling	Date 1904	Temp. °F	Weight of Tar and Water	Weight of Naphthalene			Percentage of Naphthalene Saturation of Gas	Temperature of Naphthalene Deposition °F
				Total	in Tar and Water	in Gas		
Standpipe	11-9 AM	130	9.88	.287	.283	.004	1.5%	48°F
	11-9 AM	140	4.88	.150	.146	.004	1.0	48
Condenser Inlet	11-9 AM	104	1.30	.072	.060	.012	13.3	66
	11-9 PM	110	.94	.048	.045	.003	2.3	43
Condenser Outlet	11-9 AM	72		.020	.018	.002	11.5	40
	11-9 PM	70		.033	.032	.001	9.7	37
Rotary Scrubber Outlet	11-10 AM	65				.005	40.5	50
	11-10 AM	65				.006	49.1	53

REMARKS.—In this works the gas goes from the hydraulic main to the exhauster then through a tar washer to condensers, then to rotary washers and purifiers.

TABLE XII.

Data of Tests on Condensing System of Ann Arbor Gas Works.

All weights are in grams per cubic foot of gas.

Point of Sampling	Date 1905	Temp. °F	Weight of Tar and Water	Weight of Anhydrous Tar	Percentage Naphthalene in Anhydrous Tar	Weight of Naphthalene			Percentage of Naphthalene Saturation in Gas	Temperature of Naphthalene Deposition °F
						Total	in Tar and Water	in Gas		
Inlet	7-13 PM	106°	1.709	.629	9.9	.064	.062	.002	2.2%	39°F
P. and A.	7-14 AM	107	1.676	.513	10.9	.057	.056	.001	1.1	34
Outlet	7-13 PM	105	.048	.043		.002	trace	.002	2.3	39
P. and A.	7-14 AM	105	.592	.065	1.6	.003	.001	.002	2.3	39
Inlet	7- 7 AM	86	.196	.038	2.6	.004	.001	.003	8.0	44
Box Washer	7- 8 PM	87	.246	.057	3.5	.004	.002	.002	5.1	39
Outlet	7- 7 AM	88	.051	.049			trace	trace	0.	0
Rotary	7- 8 PM	90	?	?			trace	trace	0.	0

REMARKS.—In this works the gas goes from the primary condenser through the exhauster to the P. and A., then to the secondary condenser, tar washer and rotary scrubber.

TABLE XIII.

Data of Tests on Condensing System of Jackson Gas Works.
All weights are in grams per cubic foot of gas.

Point of Sampling	Date 1905	Temp. °F	Weight of Tar and Water	Weight of Anhydrous Tar	Percentage Naphthalene in Anhydrous Tar	Weight of Naphthalene			Percentage of Naphthalene Saturation in Gas	Temperature of Naphthalene Deposition °F
						Total	in Tar and Water	in Gas		
P. and A. Sep. Inlet	8-17 PM	92	1.02	.56	7.8	.045	.043	.002	3.9	40
	8-18 AM	96	1.44	.67	9.6	.068	.064	.004	6.4	48
P. and A. Sep. Outlet	8-17 PM	90	.28	.04	10.5	.006	.004	.002	4.2	40
	8-18 AM	94	.50	.04	7.5	.006	.003	.003	5.3	44
1st Scrubber Inlet	8-17 PM	86	.23	.03	29.7	.018	.008	.010	25.7	63
	8-18 AM	87	.26	.02	30.4	.012	.007	.005	12.2	52
2d Scrubber Outlet	8-17 PM	74	.06	.02	42.8	.022	.009	.013	64.0	67
	8-18 AM	73	.04	.01	?	.019	.009	.010	53.1	63
Purifier Outlet	8-17 PM	74	.18	.07*	9.0*	.013	.006	.007	34.5	57
	8-18 AM	74	.19	.07*	5.8*	.009	.004	.005	24.6	52

*The "anhydrous tar" in this case possibly includes a considerable amount of dust from the purifiers which were under an unusually high pressure.

REMARKS.—In this works the gas passes from the primary condenser through the exhauster, P. and A., secondary condenser, and two tower scrubbers.

APPENDIX II.

METHODS OF SAMPLING AND ANALYSIS.

The method used for collecting the samples of tar and gas from the various works visited was essentially the same as that described in last year's paper. A glass tube about six inches long and containing fibrous asbestos and glass wool, a bulb tube containing picric acid solution, and a calibrated aspirator were placed in series and the gas drawn through the system at different rates depending upon the point of sampling. For the standpipe samples, most of which were drawn four or five inches from the top or on the bridge pipe, an aspirator of about one-third cubic foot capacity was used and the gas was drawn into it at a rate of about one-third cubic foot per hour. The weighed tube containing asbestos and glass wool was inserted in the hole tapped in the pipe so that the greater portion of it was outside, this being necessary on account of the high temperature of the gas at this point. When the tube was placed inside the pipe, it was found that a good deal of tar and oil passed the filter uncondensed to the picric acid bulb tube. For samples at all points except the standpipe, a cubic foot aspirator was used, the time of drawing a cubic foot of gas being two or three hours. Tar tubes in all these samples were placed inside the main because in that instance the samples collected would be more comparable to the conditions actually existing in the mains than otherwise.

The analysis of the tar collected in the asbestos filter is conducted as follows: The tube now containing tar and water incorporated in the asbestos is weighed, this giving by difference the weight of tar and moisture collected. The contents of the tube and, if the tar sticks to the glass, pieces of the glass itself are put into the volatilizing tube, which is then weighed. It is placed in series with the drying train and the naphthalene U tube, the arrangement of which is shown in Fig. 2, and the whole set in the oven shown in Fig. 1. The oven is heated to 70°-80°C and air slowly drawn through the system, volatilizing the naphthalene and moisture in the tar. The moisture is taken up by the dryer—lime and phosphorus pentoxide—while the naphthalene passes on to be frozen out in the U tube placed directly outside the oven in a trough containing ice water. The analysis is complete when the weight of the naphthalene U tube becomes constant or very nearly so at consecutive weighings after a two or three hour interval. The time required for an analysis varies with the amount of tar in the sample and usually takes thirty or forty hours for standpipe samples when the weight of tar amounts to eight or ten grams. When the analysis is complete, the volatilizing tube is again weighed, the loss giving the weight of

moisture and naphthalene given off. Having the weight of naphthalene in the U tube, we have the weight of moisture also, which, however, is at best only approximate, because there is always more or less light oils, such as benzol given off from the tar with the moisture and naphthalene, which we have at present no means of determining. Finally the volatilizing tube is set into a Soxhlet extractor and the remaining contents extracted with chloroform until free of all soluble material. After drying the tube is weighed, this giving the weight of free carbon in the tar.

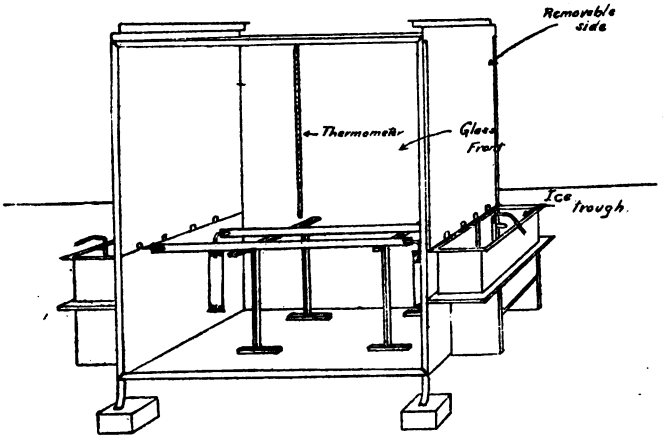

Fig. 1.

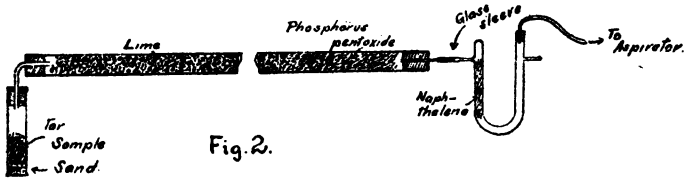

Fig. 2.

The oven used is of galvanized iron and is 20″ high by 16″ wide by 14″ deep. It is substantially as shown in the perspective, and is arranged so that eight samples may be worked at a time. For the volatilizing tube a 6″ test tube is cut in two so that the top is about 4″ in length. A piece of muslin is wired over the flare and a layer of sand about ½″ deep is introduced. The tube is then ready for the contents of the tar filters. The drying train consists of a heavy glass tube about ½″ internal diameter and 12″ long, and contains broken lime for about two-thirds of its length and phosphorus pentoxide thoroughly incorporated in glass wool, the other one-third. This introduction

of the glass wool with the phosphorus pentoxide prevents the gas from forming channels in the latter and thus aids in rendering the extraction of moisture complete before reaching the naphthalene U tube. The lime used must be extremely rapid in its reaction with water in order to avoid too great expense for phosphorus pentoxide. We have found it necessary to make our own by igniting crushed limestone to a dull red heat for two hours in a muffle. If the lumps of lime are too small, the expansion attendant upon their slaking will crack the tube. If the lumps are too large, the gas will not be dried sufficiently. We have found that a satisfactory mixture is obtained by taking everything that will pass a four-mesh sieve and will not pass a twelve-mesh. Connection with the naphthalene U tube is made as shown in Fig. 2, through a glass sleeve made air tight by a piece of gum rubber tubing placed over the whole. This prevents the naphthalene coming in contact with the rubber. It is well known that rubber absorbs naphthalene. Nevertheless, we have found it safe to use rubber stoppers in the volatilizing oven. Rubber stoppers in frequent use absorb all they can take up and after a few runs cause no further trouble.

This method allows the estimation of water, anhydrous tar, free carbon and naphthalene. The separation of the water and anhydrous tar is not very accurate, the light oils which are vaporized by the air drawn through being reported as water. The estimation of naphthalene is, however, quite accurate. The air passing through will leave the system saturated with naphthalene at the temperature of ice water, but this loss need not amount to over a milligram for each ten hours' run. It is possible that the naphthalene may be contaminated by other hydrocarbons and, as was pointed out last year, the naphthalene deposit is sometimes slightly oily and has a low melting point. An attempt has been made to determine the nature of this oil, but its small amount makes it difficult. It has been shown that it is an unsaturated hydrocarbon and it is very possible that it is the little known Indene, C_9H_8, a transition product between benzol and naphthalene which has been isolated from the tar distillates in which naphthalene occurs most abundantly. This oil has been found quite abundantly in our analyses of some tar distillates as would be expected of Indene. It is also present in some tars to a much greater extent than others. In any case, however, it seems justifiable to report it as naphthalene, because it will be found associated with naphthalene and will separate out with it on the large scale as well as the small. It is possible that the presence of this oily liquid may aid in preventing solid deposits of naphthalene, and its occurence is worthy of note.

APPENDIX III.

METHOD OF DETERMINING ABSORBENT POWER OF TARS FOR NAPHTHALENE AT VARIOUS TEMPERATURES.

A one-ounce wide mouthed bottle with a carefully ground glass stopper is fitted with a band of heavy copper wire around the neck so that the stopper may be wired in, and a wire tripod is made to slip into the bottle. About one gram of tar is weighed into this bottle, and a small glass thimble containing naphthalene in amount not to exceed twenty-five per cent of the weight of the tar is placed on the tripod above the tar. The stopper of the bottle is lubricated with a stiff rubber-vaseline lubricant and the stopper wired down. The bottle is then placed in a constant temperature oven where the naphthalene vaporizes until it has reached its vapor tension corresponding to the temperature. No more naphthalene can now vaporize except to replace that absorbed by tar. On account of the viscous nature of the tar and the small amount of surface exposed, this absorption will be very slow, so that it requires two or three months for the tar to become saturated. The process is checked from time to time by removing the bottles from the oven, opening them at once, removing the thimble of naphthalene and replacing the stopper before there has been any opportunity for the bottle to cool. After weighing the bottle, more naphthalene is put into the thimble if necessary and the bottle put back in the oven. The experiment is ended when the tar ceases to gain in weight and the total gain in weight of the tar will give the amount of naphthalene absorbed. At the higher temperature of 75°C, a somewhat different arrangement has been found desirable, as explained below.

The possible sources of error in this process are: Leaks, undue gas presures, and vapor tension of the tar constituents.

Leaks occur ocasionally and are detected by the failure of the bottle to attain constant weight and by the disagreement of results on duplicate samples. The difficulty of tight joints becomes greater with the higher temperatures because of the increasing fluidity of the lubricant, and the greater gas pressures met with, as explained below. On this account, in the 75° oven we have replaced the glass stoppered bottle by two test tubes, each about three inches long and three-fourths of an inch in diameter, the tubes being selected so that one just fits inside the other. The inner one acts as the bottle while the outer slips over it and dips about half an inch into a bath of mercury, being held vertical by guides and kept immersed in the mercury by a lead cap. The mercury seal makes a perfectly tight joint and acts as a safety valve against possible unduly high internal gas pressures, which, however, are rarely encountered.

The second possible source of error in the process lies in the abnormal gas pressures. Solubilities of almost all substances are influenced by pressure and if on account of the vapor tension of benzol, water and other substances of relatively low boiling point, the internal pressure should rise much when the bottle was heated, the solubility of the naphthalene would be noticeably increased. A direct test of pressures at 45°C showed a maximum plus pressure of two inches of mercury, a negligeable amount. Tests at 75°C showed at first a plus pressure which later gave way to a diminished pressure in the interior of the bottle, increasing for several days until it reached a maximum of about six inches of mercury. This was unexpected and is almost certainly due to absorption of the oxygen of the air in the bottle by some of the unsaturated constituents of the tar. In order to avoid sucking mercury up from the bath into the tar samples on these 75° tests, and to avoid error from abnormal pressures, it is sufficient to raise the outer tube momentarily clear of the mercury seal, when air will be drawn in to relieve the partial vacuum. This should be repeated once a day for the first three or four days, after which no further trouble need be apprehended.

An unavoidable source of error lies in the fact that the various substances in the tar possess vapor tensions, and dissolve to equilibrium in the naphthalene precisely as the naphthalene dissolves in the tar. This is shown by the occasional oily condition of the naphthalene remaining in the thimbles after they have been exposed in the bottles some weeks. Fortunately, the vapor tension of the constituents of the tar is mostly much below that of naphthalene and the error may be lessened by keeping the amount of naphthalene in the thimble at a minimum, as given in the directions. The error has been found serious at high temperatures, however, especially with some tar distillates possessing high vapor tensions, and has necessitated a longer process to obtain reliable figures as to the amount of naphthalene they can absorb. Instances have occurred where the tar showed a loss of weight after the bottle had been sealed for several weeks. It had absorbed naphthalene to the amount of possibly fifty milligrams, but it had given up more than that weight of its original substance to the naphthalene in the thimble, which had become an oily liquid. It is possible to obtain a correct result by analyzing this tar for naphthalene by the usual method of aspirating air through it. The error here lies in disregarding the amount of tar which has volatilized into the naphthalene thimble. But as this volatilized lighter portion would have a somewhat higher absorbent capacity than the residual heavier portion, the absorbent power would be reported as too low, which is better at least than reporting too high, and the error would not be a serious one.

APPENDIX IV.

METHOD FOR ESTIMATING PHENOLS IN AMMONIACAL LIQUOR.

For the analysis a sample of one liter ammoniacal liquor is filtered and then acidified, preferably with hydrochloric acid. A large amount of sulphur separates, but the amount of phenols present is so small that they remain entirely in solution. The precipitated sulphur is carefully filtered out and the perfectly clear yellow solution is placed in a bottle or jar. One hundred cubic centimeters of chloroform are added and the mixture gently shaken for an hour. The water solution becomes much lighter in color and the chloroform becomes a dark brown. The two liquids are separated and the chloroform distilled off, leaving the phenols which, after drying, are in a condition to weigh. This method is only an approximate one, as there will always be an equilibrium between the phenols dissolved in the water and in the chloroform. It would be possible to make it more exact by extracting with successive fresh portions of chloroform, but we have preferred to work a check analysis, starting with known amounts of phenols, and make the necessary correction. The phenols used had been separated from a sample of high-boiling tar distillate and were, therefore, simliar to those usually met with in tar. For the check experiment, weighed amounts of these phenols were dissolved in a liter of ammonium sulphide of specific gravity 1.01. The results follow:

EXPT. NO.	WT. PHENOLS DISSOLVED GRAMS	WT. PHENOLS RECOVERED GRAMS	PER CENT RECOVERED
1	2.285	.587	25.2
2	4.566	1.211	26.3
3	3.198	.789	24.8

The percentages recovered are small but very concordant and independent of the weight of phenol within the limits met with in practice. This is to be expected, however, as almost the only source of error lies in the incomplete removal of the phenols by the chloroform, and the relative amount of phenols dissolving in the water and chloroform will be dependent only upon the relative amounts of the two solvents. So long as the amounts of chloroform and ammoniacal liquor are unchanged, the percentage recovery should be a constant. The method is believed to be fairly accurate, provided each analyst makes his own check analysis and determines for himself the necessary corrections.

DISCUSSION.

Chairman—If there is anybody here who could completely digest that paper in one reading of it I would like to hear from him first. I think it is one of those subjects which we will take home with us and study there during the long winter evenings under a $1.98 reading lamp, or something of that sort. The results that are indicated here will probably bring forth considerable discussion over points that have been noted by operators in the conduct of works. Mr. Dewey, will you.

Mr. Dewey—I would not care to express an opinion now. I have not studied this paper over previous to coming here to the meeting. During the last year I have been out of touch with the napthalene problem. I did note somethings, however, in the reading of the paper which make it appear to me that it will be necessary to study this problem some time longer to determine the effect, for instance on the P & A. "We note in Detroit that the proportion of napthalent dissolved in tar was 94½%, while that in Ann Arbor was 95%." Of course only 1% difference, but that one per cent left in gas makes a considerable difference when it gets to the mains. "I also note that the free carbon in the tar in Detroit was 39.3%, while in Ann Arbor it was 33.2%." The point I wish to make is, why is it, that under practically the same conditions otherwise, that the proportion of napthalene dissolved in tar in Detroit is less than it is in Ann Arbor? It may be that it was because of the larger amount of free carbon, or larger amount of water in the tar. There is another point that I thought of in connection with the dissolving, or the effect of the ammoniacal liquors upon the saturation of phenols, and the setting free ultimately of the napthalene in the tar. I know it is the practice in Detroit to return the liquor from the main to the main—in other words, it is a continuous system. This is induced by means of jets—of course, you are all familiar with it—and I wondered if that ammoniacal water would have a tendency at that point to do as stated on page 16 here. I just spoke to Professor White about it, and he did not think it would, in as much as the ammoniacal liquors at that point would have ammonia salts, and consequently, being acids they would not react on the phenols. However that may be, another question I would like to ask, if I had time, is this, was the overflow from the hydraulic main being introduced into the washer scrubber or rotary scrubber. I know we did that for a little while down there, and we did not know of any bad results, and I wondered what effect, the introducing of the ammoniacal liquor which was the excess of the amount

put into the hydraulic main—what effect that would have upon the liberation of the napthalene when introduced into the rotary scrubber.

Another point which was made clear in the paper, especially in the table on page 11, as to the percentage of napthalene taken out by the P. & A. tar separator. What was the difference of pressure on the P. & A. at this point? What would be the difference of pressure on the P. & A., and what effect that would have upon the absorption of the napthalene? This point will probably be taken up in next year's work. To me, it is the most interesting paper that has been read before the Michigan Gas Association that I have heard, and in the light of the work that has been done here I think it would be interesting to branch off at some future period as to the effect and the causes—rather, the cause of the formation of napthalene. As is stated in the paper, page 9, it is not the province of the paper to determine that. There are very interesting conclusions that might be made from this paper that would lead us to believe that there is something in the peculiar manner of distillation that would acount for the formation of napthalene, under different conditions.

Mr. Tippey—In the new plant at Station A, at which these tests were made, there was a time in which we had considerable trouble with napthalene, that is, previous to the time that these tests were made. At that time the charging machine did not take the coal to the back end of the retort, and we undoubtedly made a very great deal more napthalene than while the tests were in progress. We made also a heavier tar, and a great deal more lampblack, so that at the same time we were making more napthalene we made a tar that would not be capable of dissolving as much napthalene as tar made while the tests were in progress. We had napthalene stoppages in the condensers, the washers and scrubbers. While this bad condition still existed, as far as tar extractor was concerned, we by-passed it. We let these all forward through the condenser, and napthalene stoppages ceased, and we did not have any more trouble. It has been our practice ever since that time to allow quite a little tar to go by the P. & A. We have not had any more trouble from napthalene since that time in the condensers. I noticed in some of these tests that there is more tar in the gas at the inlet to the secondary condenser than at the ouelet, showing that the gas lost napthalene in passing through the condenser. I also noticed that the tar at the outlet of the condenser contains more napthalene, showing that the gas lost napthalene and the tar picked it up. I am inclined to think if we had more perfect contact of the hot tar and hot gas before the P. & A. is reached, so that it could thoroughly absorb the napthalene if we were to remove the tar entirely at the inlet

to the condenser, we would not have any napthalene at all, and that as there would be no tar to reach the scrubber, it could not give up the napthalene at that point. But, as in our plant, we cannot get that thorough contact—enough thorough contact to take out all the napthalene before the P. & A. is reached and that allows the tar to go through. The temperature at the inlet of the secondary condenser is about 110° to about 90°. At this temperature the tar has a great affinity for absorbing napthalene, so that we have practically double contact of the tar and the hot gas, by allowing the tar to cool in the secondary condenser.

Mr. Douglas—Under those conditions, wouldn't it be wise to put the P. & A. after the secondary condenser?

Mr. Tippey—I don't know why you could not. The only reason why it should not be placed there would be that if the gas and tar, to any extent, were brought in contact below the temperature of 95 or 100 degrees, the illuminating value of the gas is deteriorated. We tried that repeatedly at our plant, dropping the temperature in the primary condenser before the P. & A. is reached below 95, and in every case the candle power dropped. We found about 95 degrees was the dividing line. To be safe we ran to above 100, and it took most of the tar out of the P. & A.—the heavy tars.

Mr. Barthold—Placing the P. & A. after the secondary condenser, there would be so little tar, I don't think the present form of the P. & A. would take out that last trace. The paper suggests that they build the foul mains larger to give the contact of the tar vapor in gas after it leaves the hydraulic main. This perhaps could be accomplished by putting in a large scrubber shell without any trays in it. I had charge of the old works in Milwaukee. They had a large shell in which the gas passed on leaving the hydraulic main. They claimed that it did a great deal to keep napthalene down in the works. I am not prepared to discuss that paper, as it requires a great deal of time to digest thoroughly, but I want to say it is going at the napthalene questio nin the right manner. From year to year the different associations have discussed this subject, and the discussion has been more or less repetition, did not bring forth anything new; and I am glad that the Michigan Association is connected with this class of work. It is along the proper line, and we will derive some benefit. This work ought to place the Michigan Gas Association right to the front.

Mr. Russell—The paper was quite a revelation to me. Like Mr. Dewey, for the last few years I have been out of touch with napthalene troubles, but the fact that the higher the temperature of tar, the more napthalene it absorbs, seems to me almost revolutionary in character. I have always maintained the way to stop

napthalene troubles was to have a primary condenser—air condenser. In other words, keeps the gas in contact with the hot tar for a long period. I had a specially good opportunity to notice that at Cincinnati. There, there is no P. & A. whatever, but they have a long series of pipes acting as a primary condenser, and all during my experience there we had absolutely no trouble with napthalene, although I will say that tars went past to the purifier. Evidently the contact of hot gas with hot tar was doing something for napthalene in those works.

I do not see why Detroit should have more tar where they have more free carbon than at Ann Arbor. At Detroit they have lower temperatures, and I should think it would be just the opposite condition, in regard to tar.

In connection with the whole paper, I think the work should be continued another year. It seems to me that this is the first paper that has pointed out anything definite to the gas man. I think most of us, after reading it, want to go home and study by lamplight; and are more apt to get out in the works and raise the temperatures, and lower them, and see what the effect is. I think another year they will be able to tell us just how to get the napthalene out of the gas, and just where we should get it out. In other words, just how to handle it, and what sort of apparatus to use, although gas men will use their judgment about that. After that is determined it seems to me they ought to tell us how not to make it at all, that is, not to make it in any more than a reasonable amount. One problem is to get rid of it after you have made it; but another problem is how not to make it.

Chairman—What is your experience at Grand Rapids?

Mr. Traver—My experience has been similar to Mr. Tippey's. We have had a great deal of trouble with napthalene in the line of scrubbers, fresh water scrubbers, but since we got rid of that by by-passing and P. & A., and allowing some of the tars to go through, we have not been bothered lately at all. The paper is very interesting to me at the present time because we have just changed over our condensing system entirely. We are pumping the gas hot, and the gas is being kept in contact with the tar much longer at this high temperature than any other works in the State at the present time. The result will be probably that the man who has the fellowship for next year, Mr. Barnes, will get some results that he could not get in any other works in the State.

The paper itself was certainly the most interesting napthalene paper I think that has ever been written, but I have not thoroughly digested it, and probably won't for a long while. It will take a lot of study.

There is one point, Mr. President, that impresses me, and

that is in the amount of napthalene formed at different hours. I always thought that more napthalene would be formed during the latter hours rather than the first, where the gas flow is very swift. We find according to these experiments that is not the case. I don't know exactly how to explain that. I would like to ask Professor White if he can give any explanation why that would be?

Prof. Campbell—I do not know as I am in a position to add anything to this paper. I will simply say that I feel very much gratified at the way his paper has been received here; and I would like to take occasion also to say that it seems to endorse the position on which the Gas Association ahs been supporting our fellowship in response to the request that I made at the time we got them to support the fellowship. The function of the university is to develop new truths, new facts, simply to bring out facts themselves irrespective of their bearing; and this paper certainly has brought out a number of extremely interesting facts. As Mr. Traver—especially Mr. Russell—has said, we might teach them not only how to remove napthalene ,but also how to prevent its formation. Now, perhaps I might say that I do not feel that it is our place to show the mechanical side of how to remove napthalene. The object of this research work is to bring out knowledge, definite facts as to why and when napthalene is removed. Mr. White has proven to you that with a rise of temperature there is an increased solvent action of the tar, and he has brought out some facts. Now, I have no doubt in my mind but what there is ingenuity enough among the members of the Gas Association to apply that knowledge practically for the benefit of the gas business. It is not the object of the university to apply this knowledge. We try to bring out new knowledge.

Now, the broader problem which Mr. Russell has suggested there, as to the cause of napthalene, brings out, as stated in the paper, the whole question of distillation. To my mind, one who thinks ahead a little bit can conceive what an enormous field there is there for research. It has been scarcely touched at all, and I think it is one of the most promising fields for subsequent research. In this paper there is shown a variation in the solvent action of tar, as influenced by temperature. Then comes the question that we see often from this, that there is a variation in the solvent action of different tars at the same temperature. Now that at once would lead to the question in the destructive distillation of coal, what is the relation between time and temperature, and different coals, and combination coals and tars. If one stops to think on that he will see at once there is work enough there for years to come. In research work for the production of new facts and new knowledge I think there will be no question but

what the gas men themselves can appreciate new facts and can apply them to the betterment of the gas industry.

I appreciate very much the support that the fellowship has received, and I trust that the members will feel that their support and the money they put in there is really well invested. (Applause.)

Chairman—I think I can answer the Professor for the Association, that they have a most high appreciation of the extremely valuable, and I might say, unselfish work which the University is doing, and the hearty manner in which they have carried on the work, which absolutely could not have been done by any member of the Association. I do not think it could have been done by any company individually, by reason of the length of time and the large facilities required, and the collateral facilities, if I might use the term, which the University has for this work. It certainly is gratifying to the Association.

Mr. Cleary, have you anything to say in answer to the inquiries. Are there any questions that any member would like to ask further in regard to this?

Mr. Dewey—One question I would like to ask—I was not quite certain at that time but what it was treated in the paper—that is, Prof. Campbell spoke of it—the solvent action of different kinds of tar. Why I ask this is from the experience at Grand Rapids in dividing it by by-passing and allowing a portion of the lighter tars to pass the P. & A. What is the absorbing power of that very light tar that we allow to go through? I have been unable to find out. I think probably the reason why Detroit and Grand Rapids have had different results from what we would expect is probably explained by the fact that this tar undoubtedly has a very high absorbing power, and the napthalene must be absorbed by this light tar.

Chairman—Are there any other points or questions?

Mr. Russell—It occurs to me that both Grand Rapids and Detroit's difficulty is rather more subject to the time element than anything else. When they are operating the P. & A. differentially, they increase their absorbing surface and the gas passes too fast. All through the paper it has been shown that time played a very important part. I suggest that might be true in the P. & A., that it flows at such a speed that it has not time; in other words, if you had a larger P. & A. it might stop that difficulty.

Mr. Ball—I have not anything to add. I was just wishing that I had had time to study this paper before I came down. I notice that the tar at a temperature of 106 degrees absorbs almost 50% of napthalene, and the tar in the hydraulic main is perhaps not quite that temperature, but almost that. It seems to me in

our experiments last year we found that it did not hold over 5% to 6%, and it occurred to me, what became of that napthalene, whether it was redistilled or volatized in some way. That is the suggestion that occurred to me.

Chairman—I will ask Prof. White to close the discussion on this paper.

Mr. Stiles—I would like to know if there has been any experiment heretofore showing the amount of napthalene in the gas made from different kinds of coal, Illinois coal or coal from different localities?

Prof. White—A number of gentlemen have dwelt upon much the same points, so I shall not attempt to take up the questions as they were asked one by one, but rather the different subjects.

I think the first one was by Mr. Dewey, in regard to fixed ammonia taking out phenols from the gas. I do not think that fixed ammonia would have the same effect as volatile ammonia. In the hydraulic the ammonia is largely firmly fixed as salts, but in the scrubber where the volatile ammonia is largely in excess, I think that the ammonia will continue to act in removing phenols, unless some steps be taken to actually acidify the liquor in the scrubbers, which would be something of doubtful practicability. At least it requires a different structure of scrubber.

In regard to different pressure of the P. & A. we have no complete records of the differential pressures in many of our works tests, for they did not have differential pressure by which we could make tests. Of course the greater gauge the differential pressure the greater is the rate of gas passing through perforations in the screen of the P. & A. and there can be such a thing, I can imagine, that the gas will pass through so fact that the tar would not be deposited. I can see that gas passing through very fast at a high differential pressure might not deposit tar, as the one passing through more slowly. It is complicated, however, as almost all these questions are complicated by a number of different factors. One of them, I am quite certain, is the temperature of the gas entering the P. & A. The important point about that is due to the difference in the viscosity of the tar at the different temperatures. If the temperature of the P. & A. is low there has been more tar separated out in the primary condensers, there is not so much going to the P. & A., and that tar is quite stiff, and as it goes through the perforations and strikes the baffle plate it has a tendency to stick and be removed from the gas. If the temperature at the outlet of the primary condenser is high more tar will pass through to the P. & A., and that tar will be fluid, and the tendency will be when it strikes the baffle plate to splash back, especially if it is going at a high veloc-

ity; and under such circumstances I can see that more tar will pass through.

The question as to the effect of the denser tars and lighter tars, as they go forward, is one that will have to be settled by more work. We have one or two tests under way on that point, but it takes three months to determine the amount of napthalene which tar can take up at a given temperature; and there are tests going on at the University which will not be out in time to report at this meeting. In another year we will have some further evidence on the subject. The practice at Detroit and Grand Rapids of letting some tars purposely pass the P. & A. is extremely interesting. Some tests have already been made which were not reported on, at Detroit. With Mr. Tippey's co-operation we expect to keep on until we find just what the effect is of letting some of those tars go forward.

When we get to the question of the formation of napthalene we are very much in the dark, and I think I can not answer any of the questions which have been put in regard to the formation of napthalene. We know that apparently trivial things influence the amount of its formation very much. At the University this year Mr. Barnes tried for six months to distil one sample of coal in the small laboratory apparatus, where we had our conditions as nearly uniform as we could get them, and he tried to determine the influence of temperature on the amount of napthalene formed in that laboratory apparatus, but in almost every case there was evidently some variable which was more important than the variable of temperature. We came to the conclusion after some eight or ten distillations that it was practically the method of charging that little retort that was causing most of our difficuly. The method of charging was more important than the temperature. We made some experiments in the works, and we think the data is not sufficient to allow anyone to explain them, and so they are put away until we get enough information to let us explain the results we have. We know the charging exerts a big influence, and the temperature must exert some influence; but we do not know why it is that Detroit has a higher percentage of free carbon than Ann Arbor.

Prof. Campbell has outlined very well, I think, our plan in attacking this problem. We hope to attain considerable further information during the coming year. If the question is to be solved under the best conditions, it can only be done when we can regulate or eliminate as many of these absolute variables as is possible. We ought to be able to work with only one condition at a time, and we will never be able to do that in the gas works because there are certainly ten, or possibly 100 differences, which hinder us. The ideal way would be to isolate a single full-sized

retort provided with its own condensing system. Under those circumstances we could probably regulate our conditions fairly well and obtain results much more quickly than we otherwise could, and I am quite confident that those results could then be applied to the full-sized plant and be found applicable.

I have to thank the Association and the gentlemen for the very cordial support which we have everywhere found in conducting the experiments we made. Wherever we have been at the different works there has been the utmost courtesy shown, and we beg to thank the Association for it. (Applause.)

Chairman—Prof. White, I do not know that I ought to call on you for anything more, but I would like to ask what percentage of tar you have found in the gas—percentage of the total tar produced, you found in the gas at the entry to the scrubbing system, in those experiments, os is it given?

Prof. White—It is not given in so many words, but only one to three per cent of the total tar produced ever gets as far as the scrubbers.

Chairman—The reason I asked is, it seems to be very difficult to eliminate all the tars—tar vapors after the use of water or ammoniacal liquor, in some manner. It is evident from what you have been doing this year that to eliminate any tars with ammoniacal liquors is something we will look upon as a distinct question. If we can get all those tars out by mechanical means it would seem that we would be largely at the end of this trouble. As I take it, from the result of the work this year, there is something that I do not think has ever been determined before. Still, as you suggest, a man would not think of correcting the conditions under his reading lamp; I think that is one of the things we will have probably to study under the same reading lamp.

I had a discussion with Prof. White a few days ago in respect to some proposed apparatus for the University. You could conduct this work in a little more systematic manner. It was suggested last year that there should be an experimental plant put up at the University, making it possibly to a quarter size, provide a complete plant from the retort all the way through to the holder; and the University acted on that matter, and were far-sighted enough to say that they would find space and accommodation for anything that we would supply, and it is in such shape that it could be put in at any time, but it did not seem that that would meet the conditions which we were striving for. If the retort were quarter size the gas produced in the rear end of it would have only half the travel of gas in a retort such as we are using. We use about a nine-foot retort, because it is about as far as a man can throw coal. We would not want to use a horizontal retort because we would have a disproportion of invest-

ment to capacity. So, there are practical limits as to the size of the apparatus, and to produce gas in a retort which would not give the same conditions as a retort used in practice would be artificial conditions. It seemed to us that the present work for us—possibly looking at it from a commercial standpoint—would be to let the University endeavor to prevent some of the troubles which we have been having when they are producing under customary circumstances. It is now proposed, as Prof. Campbell suggests, to isolate three retorts in the Ann Arbor works. Mr. Douglas has kindly consented that this shall be done under certain conditions, which are exceedingly favorable to the Association. We are now endeavoring to devise apparatus which can handle a small quantity of gas and give it precisely the same treatment, actual and theoretical, which it would receive in a works where a large quantity is handled. It may seem strange to some, but it would be a simpler process to handle a million feet of gas than it would to handle five thousand. However, we hope before another year to have something along this line accomplished. I think without further action on the part of the Association a vote of thanks will be entered upon the record to the Faculty for the work that they have done.